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SOILS and their Crop Adaptations in New Hampshire

By

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Foreword

Since November, 1952, the National Cooperative Soil Survey has been a joint activity of the Soil Conservation Service and the Agricultural Experiment Stations in the land-grant colleges of the nation. In New Hampshire, soil maps and reports have been made and published cooperatively by other agencies of the United States Department of Agriculture and the Agricultural Experiment Station for the following counties: Cheshire, Coos, Grafton, Hillsborough, Strafford, and Sullivan.

Because of the demand, refinements in mapping techniques are constantly being made. Also, individual farms are now mapped on a larger scale and on an aerial photograph to serve as a basis for farm planning. Within the next 20 years, all counties in the state will have been remapped on a photographic base and on a larger and more useful scale.

The first part of this bulletin is background material for a better understanding of soils and their use. There follows a discussion of 36 soil management groups and their major crop adaptations. A section then explains the relationships between forests and soils, and types of farming and soils. The appendix lists all soil types mapped in New Hampshire along with their soil management group, and finally the characteristics are shown of soils in need of drainage.

We hope that this bulletin is the beginning of a series of joint publications of the Soil Conservation Service and the New Hampshire Agricultural Experiment Station.

Harold C. Grinnell
Director

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Soils and Their Crop Adaptations in New Hampshire

By

LLOYD E. GARLAND, HENRY R. ADAMS
and ROY L. DONAHUE[1]

I. Soils and their Characteristics

A KNOWLEDGE of our soils and their use is necessary because soils support plants and animals which provide us with food and fiber. Our plants, including those grown for lumber, food, fiber, or for beauty, all grow in the soil. The sale of these products from our soil provides part of the living for many of the people in New Hampshire.

Soil is the upper two or three feet of the relatively thin surface layers which in most places in New Hampshire cover the bedrock. Through the centuries, the surface material of broken rock fragments has been subjected to the action of the weather. The material has undergone heating and cooling, freezing and thawing, and leaching by rain. Plants and animals have grown on and in this material. The original material now has mixed with it the partially rotted remains of the animals, and roots, leaves, and stems of countless generations of plants. The plant and animal residues have been worked on by earthworms and other animal life, as well as by the lower forms of plant life, such as fungi. In addition, each cubic foot of the material contains millions of bacteria and other microscopic plants and animals which get their living by breaking down organic matter and rock particles to obtain food.

The result of all of this activity is that the original material in the surface layer has been markedly changed. It has some resemblance to the original material, but it is not the same. Some of the large rock particles have been broken down into smaller ones; also, some plant nutrients have been dissolved and carried away by water, while other nutrients have been put into a form in which plants can use them more readily.

It is this changed surface material that we call soil. In it grow most of the plants which we use for food, feed and fiber, and for beautifying the landscape.

There are many different kinds of soil. Some soils are sandy, coarse and open to the movement of air and water, while others are clay-like and tight. Some are deep to bedrock and others are shallow. Some soils are

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formed under naturally well-drained conditions, while some are waterlogged all of the time. Since these and other conditions may occur in varying combinations, many different kinds of soil can be recognized, classified, and mapped. For more than 50 years, the U. S. Department of Agriculture and the State Agricultural Experiment Stations have been making surveys in which the different soils are classified, named, and mapped.

Soil surveys have been made and published for six counties in New Hampshire within recent years.[1] These soil surveys were published on scales of either one mile on the ground equals one inch on the map or two miles on the ground equals one inch on the map.

More recently, in connection with the work of Soil Conservation Districts, more than 1,000,000 acres have been mapped on aerial photographs with a scale of one mile on the land equals four inches on the photograph. At present this mapping has covered more than 4,500 farms and is still in progress. So far it has been conducted mainly on farm lands with little work in the large forested areas. With the larger scale and the photographic base, it is possible to outline areas as small as two or three acres and show the locations of each area in relation to field boundaries. None of these maps has been published, but they are available for inspection in the local offices of the Soil Conservation Service and the New Hampshire Agricultural Experiment Station, which are working jointly on the National Cooperative Soil Survey.[2]

Characteristics

Texture

One of the principal characteristics of soil and one of the easiest to identify is texture — the relative sizes of the soil particles. If we exclude gravel and boulders, the soil particles may be divided roughly into three classes according to size. These are called sand, silt, and clay. Sand particles are ones that feel gritty when rubbed between the fingers, and they possess little power to stick together. The pore spaces between the sand particles are usually large and continuous. Clay particles, on the other hand, are so small that they can't be seen without a microscope. When moist, clay is sticky, but when dry, it is usually stuck together into hard lumps. The pore spaces between the clay particles are very small and frequently are blind pockets. Silt particles are between sand and clay in size and in their other properties. Dry silt feels like flour when rubbed between the fingers. When moist, silt is somewhat slick or slippery but not very sticky.

A soil consists of sand, silt, and clay in varying proportions. For this reason the terms "sand", "silt", and "clay" are used not only to classify the particles but also in making up the soil name. A soil composed mainly of sand particles is said to have a sand texture. Since the sand particles do

[1] Soil survey reports and maps are available for Grafton County, published in 1939; Coos County, 1943; Strafford County, 1949; Cheshire and Sullivan Counties, published together as one report, 1949; and Hillsborough County, 1953. An early survey of Merrimack County was published in 1906 and is out of print and not available, except in some libraries. The survey of Rockingham County is rapidly approaching completion. County soil surveys are in progress in Belknap and Carroll Counties, and Merrimack County is being re-surveyed.

[2] For a complete list of the soils mapped, refer to Appendix A, page 80.

not stick together, a sandy soil is easily tilled. The large pores between the sand grains permit the rapid downward movement of water but provide little opportunity for the soil to hold enough moisture for the use of plants. Hence, such soils dry out quickly and can be tilled early in the spring, but they are very droughty. A soil in which the very fine particles predominate so thoroughly that they completely outweigh the effects of any silt or sand present, is called a clay soil. Such a soil is difficult to work and forms clods if plowed when too wet or too dry. The small pores in clay soils will not transmit water readily, and for this reason, these fine textured soils are frequently not well drained. The fine particles hold a great deal of moisture for plant use, but if too much water is present, the water crowds out the air which is just as important as water for plant growth.

Soil Conservation Service

A soil scientist determining texture in process of making a soil survey.

A loam soil is one in which sand, silt, and clay occur in such proportions that each has an equal influence on the character of the soil, with no one predominating. So it can be said that the word *loam* means a mixture. If the effects of sand, silt, and clay are evident, but one of them predominates, the name of that size class is added to the word *loam* in making the textural name of the soil. We have sandy loams where sand is the main constituent, silt loams where silt predominates, or clay loams where the clay has the greater influence on the properties of the mixture.

Inside these broad classes of soil there are finer distinctions which are recognized on the soil maps. A soil composed mainly of sand is called a sand, but the presence of some silt and clay is recognized by calling it a loamy sand. Since the sand grains vary somewhat in size, a further breakdown is made in the names of the soils. For example, we may have coarse sand, or fine sandy loam, or even very fine sandy loam.

In New Hampshire, no surface soil contains enough clay to be classified as a clay soil. The nearest approach to a clay soil is one which is high in both silt and clay and is called a silty clay loam. If the soils in the State were arranged in the order of decreasing amounts and sizes of sand and increasing amounts of silt and clay, a representative list would be as follows: sand; loamy sand; sandy loam; fine sandy loam; silt loam; silty clay loam.

Taken in the above order, there is a general decrease in the ease of tillage, a decrease in the ease of water movement and root penetration, and an increase in the ability of the soil to hold available water and plant nutrients. Unless proper steps are taken to maintain it, humus will burn out and disappear faster from the sandy soils than from the silt loams or silty clay loams. Quite a large part of the soils in New Hampshire consist of fine sandy loams, very fine sandy loams, and loams.

Slope

Although not so directly related to the internal make-up of the soil as texture, the slope of the land surface has important effects on land use and treatment. The steepness of the slope affects the safe use of machinery. The short steep slopes influence the rate at which water runs off, and therefore has an effect on the amount of water which seeps into the soil. For the same reason, the steepness and length of slope influence the possible hazard of soil erosion.

On well-drained soils, the steeper the land the less it is used for cultivated crops. This means that there is a higher proportion of cultivated land on the level or nearly level areas than there is on the steeper slopes. On the soils with poor natural drainage, the situation is reversed and there is more cropland on the sloping areas where excess water can run off than there is on the level areas where water may stand for some time. Most farmers in the State do not try to plow or to harvest crops on land that is steeper than 20 percent.[1] For frequent tillage, they usually select fields with a grade of less than 8 percent.

Stoniness

Probably the condition which has the greatest effect on the use of land in New Hampshire is stoniness. The presence on the surface and throughout the soil mass of many stones larger than eight inches in diameter limits or prevents cultivation. When such stone fragments make up most of the total soil, the space for holding moisture and the space in which roots can develop are limited. Some of the less stony land may be cleared and used for crop production. The size of the boulders and the number which would have to be moved are factors which must be considered in deciding if stone removal is economically sound.

[1] A 20 per cent slope represents a vertical rise or fall of 20 feet in 100 feet of horizontal distance.

Agricultural Conservation Program Service

This farmer decided that the removal of the boulders was economically sound.

Soil Conservation Service

Poor drainage in the soil has restricted efficient use of this entire field.

Natural Drainage

Good soil drainage is important to the farmer. It is important for a soil to hold some moisture for use by plants, but it is also important for the soil to contain air as well as water in the pores. To get this condition, the soil must be able to allow excess water to move downward readily. When the soil is too wet, the air is replaced by water. If this condition continues for several days, many plants suffer or die. Poor drainage limits the kinds of plants which will grow successfully. To the farmer, poor drainage presents another handicap, too. It is much more difficult for him to work the wet, muddy fields, and for this reason crops are often planted too late.

Poor natural drainage in the soil may result from several causes. One of the principal causes is a high water table. Shallowness to bedrock or to a compact layer markedly influences natural drainage. If the surface soil takes in water faster than the subsoil can transmit it, a temporary perched water table may develop, entirely separate from the regular ground water table. A perched water table has the same effect, however, in drowning the roots of the plants. Surface slope is another condition affecting drainage. On sloping land some of the excess water can run off over the surface. On level areas or in basins, however, any water falling on the land in the form of rain or snow, or running onto the land from adjacent hills must either soak away through the soil or lie there until it evaporates. In sandy soils with favorable soil structure, such water may disappear rather quickly, but on silty or clayey soils, temporary ponds may stay for weeks and the soil beneath them will be saturated.

Another condition which may cause poor natural drainage is seepage. Water may be moving downhill through some deeply buried layer so that plants at the ground surface are not affected until the water breaks out to the surface, forming a seep spot or wet-weather spring. Such wet spots interfere with the use and tillage of a field.

In this bulletin, soils are considered in four classes according to wetness. These include: (1) *well-drained soils;* (2) *moderately well-drained* soils which are saturated to within 18 inches of the surface for periods of a

few days or a few weeks, usually during the spring; (3) *poorly drained* soils which are saturated to within a few inches of the surface for periods of several weeks or even months during each year; (4) and *very poorly drained*, which are saturated to the surface most or all of the time. The last two conditions impose a very definite limitation on the use of the land.

Color

Color differences in soils are easily seen and are often used in soil mapping. Actually soil color in itself is not important since it has little if any effect on plant growth. It may, however, be the result of some important but obscure condition in the soil.

Frequently the subsoil has a richer brown color than the surface soil, which is an indication that the surface has been leached during the process of soil formation. In the northern part of the State, and at higher elevations in the southern part, this leaching has been great enough to form a light grey or almost white layer just beneath the organic layer. This grey layer is usually thin, and if the land has been plowed, the grey material has been mixed with the soil beneath and the layer has disappeared. In some parts of the State the soils have been formed from rock materials containing oxidized iron to give a brown or reddish color to the soil. Although these color conditions are quite easily seen, neither of them is now thought to be highly important in affecting the use or treatment of the land in New Hampshire.

Color is an important clue in recognizing natural drainage conditions. Soils with impeded drainage usually have a darker surface than the well-drained soils, because of the greater accumulation of humus. As a general rule, the darker the surface soil, the poorer the drainage. Also, in the poorly drained soils the subsoil color is usually mottled, with spots of brown, yellow, or red intermixed with grey. The depth to this mottled condition is important. The closer the mottling is to the surface, the poorer the natural drainage condition of the soil.

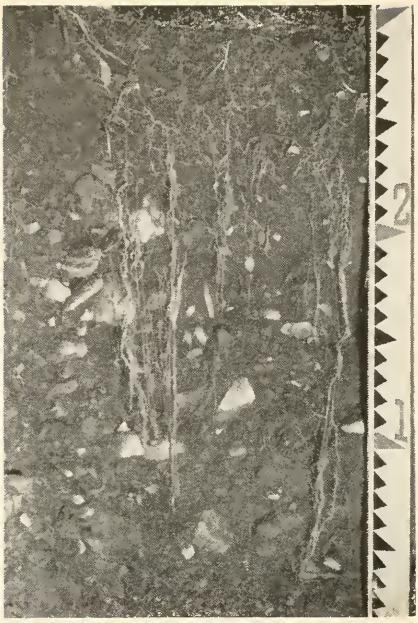
Effective Depth

If the soil consists of a mantle only a foot or two thick over bedrock, roots are limited in their depth of penetration and the shallow layer of soil can hold only a limited amount of moisture and nutrients. As a result the deep-rooted species of plants are not suited to such soils and plants growing on shallow soils will suffer from a lack of water and nutrients. If the surface of the bedrock is a level plane or in the form of a basin, the rock will hold water which seeps down to it so that the soil above it is saturated for a part or all of the year. On a sloping surface, water which accumulates on top of the rock may seep down the slope and come to the surface at some lower place, causing a wet spot in the field.

Somewhat the same results may develop if a dense or compact layer of soil material occurs near the surface. The severity of the undesirable results depends on the degree of compaction. Some such layers may slow the movement of water without stopping it entirely so the results are less injurious. In fact, there is evidence that in some cases the result of a compact subsoil may be beneficial. Under a sandy, open topsoil which holds very little moisture, such a compact layer may increase the amount of water that is held within reach of the plant roots.

Depth to the water table is also important. If the water table remains at a constant level close to the surface, most plant roots will not live below that level even though the material is open and otherwise easily penetrated by roots. If the water table fluctuates during the season, a plant with roots extending only to the highest water level may suffer from drought during dry weather. If the roots grow downward during the dry period, they will be drowned when the water table rises again; so, strange as it may seem, wet soils may also at times be droughty soils.

Depth to a layer of very loose, open gravel or coarse sand is an important factor in some soils. If the surface soil is very coarse, or if there is only a foot or two of finer soil over coarse material, the soil has a low capacity for holding available water. Such soils are droughty. Very few plants grow well on droughty soils and these are mostly of the deep-rooted type. Alfalfa roots, for example, may extend to great depths on such soils. Even if irrigation is practiced, it must be done frequently on these droughty soils.



Allan B. Prince

Deep-rooted plants are better adapted to the coarse-textured gravelly soils.

Structure

The arrangement of the particles, which is known as soil structure, affects the use and treatment of the soil. The particles may not stick together at all or they may join together to form crumbs or granules. The soil particles may form one solid mass with no particular pattern of breakage when twisted in the hands, or they may give a massive appearance but still break easily into definite sized blocks. The blocks may be arranged in upright columns, separated by cracks large enough to carry off any excess water. Soil particles may also be arranged in plates, lying parallel to the ground and overlapping like shingles, so that the downward movement of water is greatly impeded. Even in the sands, which are usually open, compaction can force the particles together with fine grains between the bigger ones, so that the pores are smaller and the ease of water movement and root penetration is reduced.

II. Soils and Climate

CLIMATE is the dominant factor in soil formation. Climate, acting primarily through temperature and precipitation, largely determines the kinds of trees and other plants which occur in any area. Losses of plant nutrients by leaching and erosion are also determined by climate.

The climate of New Hampshire is influenced by many factors, including: (1) the northerly latitude (distance from the equator); (2) the elevation; (3) the nearness to the Atlantic Ocean; and (4) the direction of the prevailing winds.

Due to differences in climate, the soils in the northern part of New Hampshire and at high elevations in the central and southern part of the State have a greater thickness of organic matter on the surface than do those in the southern lowlands. The greater accumulation of organic matter in the highlands is not due to more being produced but to the better preserving action of cool temperatures. Soils in the highlands are also more highly leached in the surface layers because of more organic acids produced by the decay of strongly acid organic matter and because of more precipitation.

Precipitation

PRECIPITATION in New Hampshire on the average comes one day in three, but in the mountains one day in two. This frequency seems to be very great but it must be remembered that a day of precipitation is defined by the U. S. Weather Bureau as a day in which at least 0.01 of an inch falls. It is also well to note that snowfall is considered as precipitation and that on the average, ten inches of snowfall is equal to one inch of rain.

The distribution of precipitation in New Hampshire is considered as desirable for plant growth as any place in the world, averaging three to four inches each month in the year. For the best growth of a farm crop such as corn, however, the desirable summer rainfall, when compared with the rainfall at Concord, New Hampshire, is as follows:

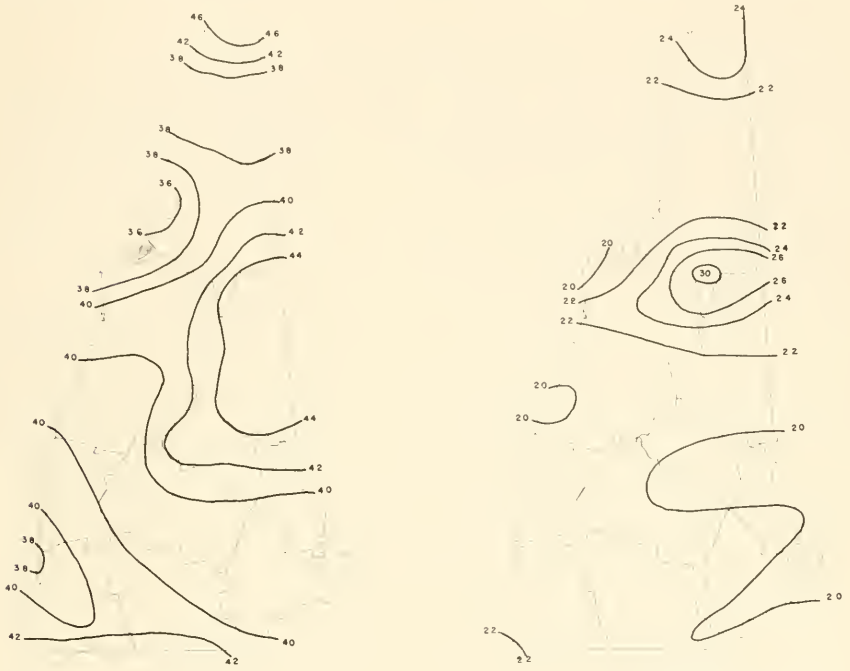
Table 1. Estimated Deficiency of Summer Rainfall for Corn at Concord, New Hampshire

Month	Average Rainfall at Concord, N. H. (inches)	Desirable Rainfall for Corn (inches)[1]	Deficiency for Corn (inches)
May	2.8	4.0	1.2
June	3.2	5.0	1.8
July	3.5	8.0	4.5
August	3.3	5.0	1.7
Total	12.8	22.0	9.2

[1] *Ohio Farm and Home Research*, May-June, 1953.

These data show that the total summer precipitation at Concord averages 12.8 inches, but that corn needs 22.0 inches. This is a moisture deficit

of 9.2 inches, which must be supplied from irrigation if maximum corn yields are to be obtained. For an average year, the best production of forage crops at Concord will require an additional 5 inches of water supplied from irrigation.



1941 Yearbook of Agriculture

Figure 1, on the left, shows the average annual precipitation in inches in New Hampshire, while Figure 2, at right, shows the average warm season precipitation in inches in New Hampshire from April to September, inclusive.

Average annual precipitation in New Hampshire varies from 38 inches in the southwestern and northern parts of the State to 46 inches in the extreme northern part. (Figure 1.) Several mountain peaks receive about twice these values. Average warm season precipitation (April through September) varies from 20 to 30 inches. (Figure 2.)

Temperature

THE AVERAGE annual temperature for New Hampshire varies from 40 degrees Fahrenheit in the northern part of the State to 45 degrees in the southern part. January temperatures average from 12 to 22 degrees, increasing fairly regularly from north to south. (Figure 3.)

In the north the 12-degree average January temperature and the 66-degree average July temperature (Figure 4) affirm the statement that the cold temperature in the northern areas helps in the accumulation of soil organic matter. The average annual temperature of 40 to 45 degrees is approximately the temperature maintained in home refrigerators to preserve

food. In like manner, tree leaves and other organic materials are well preserved and therefore accumulate more in northern New Hampshire and in the highlands than in southern New Hampshire lowlands.

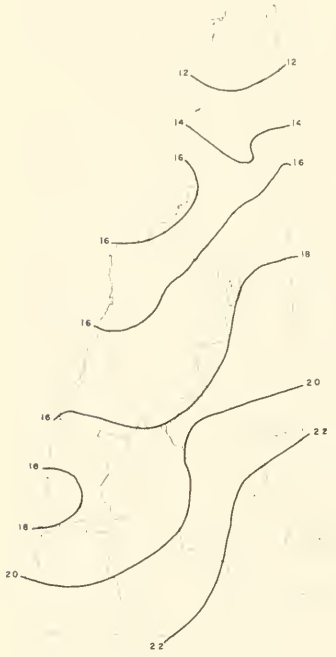
Growing Season

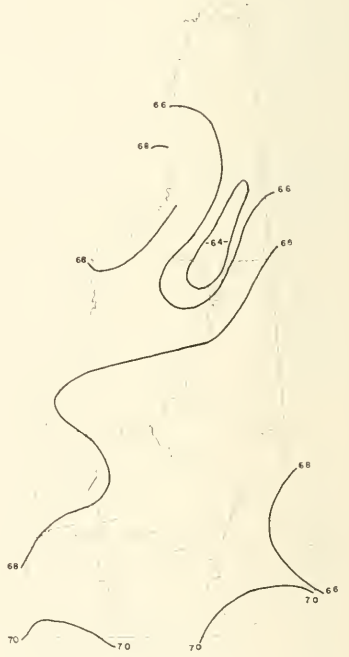
EACH PLANT has its own requirement regarding the number of days necessary to mature. Corn, for example, requires 80-120 days, depending upon the variety. Plant breeding has developed quickly maturing varieties of corn, tomatoes, watermelons, muskmelons and many other crops which are adapted to the short growing seasons found in New Hampshire. While plant breeding has made rapid progress, there is a limit beyond which certain plants cannot be adapted to the short growing season in various parts of New Hampshire.

The length of the growing season is shown in Figure 5 as an average number of days without killing frosts. The growing season averages 100 days in the northern part to 140 days in the southern part of the State.

The average last killing frost in the spring shown in Figure 6 determines the best planting dates. The map shows the last killing frost to be June 10 north of the White Mountains and May 20 in the southern lowlands.

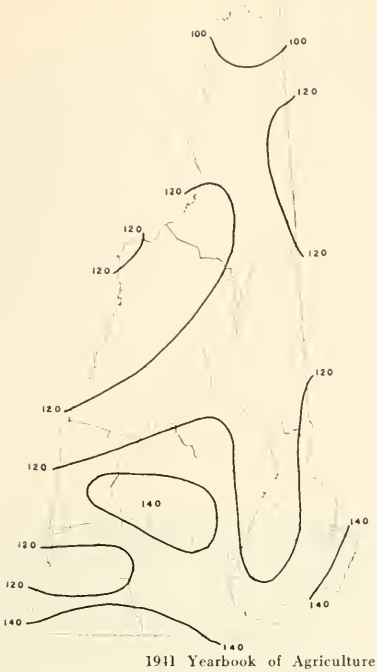
As a general rule it is best to plant such crops as corn approximately the time of the average last killing frost in the spring. This means that in southern New Hampshire, May 20 is a desirable date for planting corn.





1941 Yearbook of Agriculture

Figure 3, at the left, shows the average January temperatures in New Hampshire, while Figure 4, at the right, records the average July temperatures.



1911 Yearbook of Agriculture

Figure 5 is a record of the average number of days without killing frost.

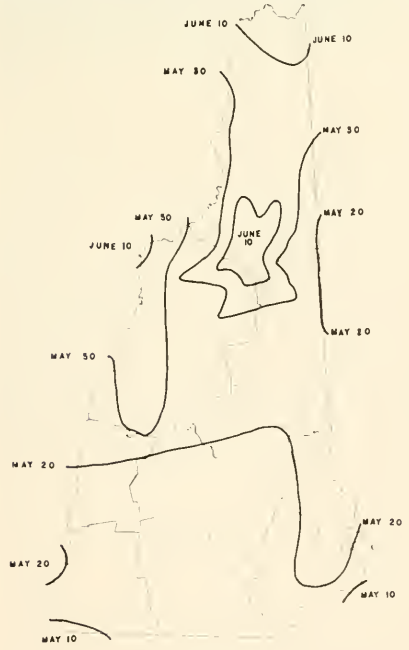
This information is directly related to soils in this way. Poorly drained soils, although otherwise desirable for corn production, are usually too wet on May 20 to plant corn. For that reason, the crop must be planted later and the yields on the average will not be satisfactory.

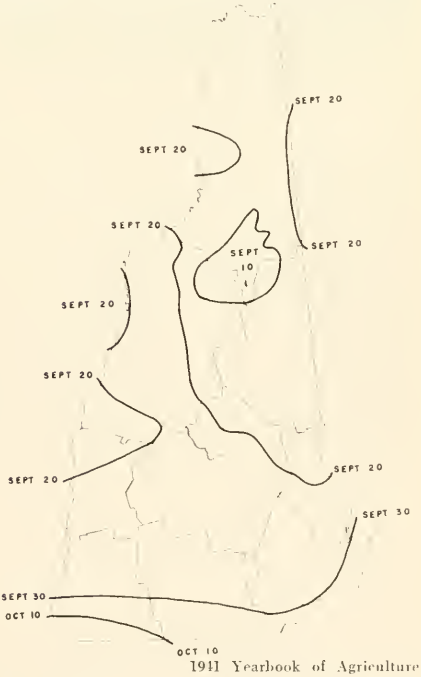
Harvest dates of apples, potatoes, pumpkins, corn, tomatoes and many other crops are related to the first killing frost in the fall.

The map in Figure 7 portrays the average first killing frost in the fall as September 10 in the White Mountains and September 30 in southern New Hampshire.

Some soils occur in frost pockets, near large bodies of water, or on various facing slopes in such a way as to produce sharp local variations in growing season from field to field.

Before large amounts of money are invested in new enterprises which are sensitive to frosts, the local as well as general factors which influence the growing season should be thoroughly studied.





1911 Yearbook of Agriculture

Figure 6, at the left, shows the average dates of the last killing frost in the spring. Figure 7 records the dates of the first killing frost in the fall.

Snowfall

NEAR THE seacoast, New Hampshire receives approximately 50 inches of snow a year, but seldom does any one snow cover last for more than a few weeks. In the northern part, 90 inches of snowfall is received as a yearly average and it is usual to have continuous snow cover for approximately four months.

Continuous snow cover makes an ideal blanket of protection for perennial crops, resulting in less heaving of plants in the northern than in the southern part of the State.

Soil Conservation Service

A snow cover in winter is an ideal protective blanket for perennial crops.

III. Our New Hampshire Soils

Several thousand years ago an ice sheet (glacier) crept down from the north and covered the entire State. This great mass of ice, possibly a mile in thickness, acted like a giant bulldozer and scraped the surface of the ground, plucked boulders from the bare mountain sides and carried this material to the south, crushing and mixing it as it went. Later, as the ice melted, the rock material in the ice was dropped to form an irregular blanket over the solid bedrock beneath.

In places, the bedrock is now exposed and bare; in other places, it is covered by a mantle ranging from a foot or two up to 40 or 50 feet in depth. This mantle is a mixture of all sizes of fragments from the very finest clays up to boulders as large as a house.

This ice-deposited, non-stratified material, called glacial till, is the source of soils over much of the State, but some of the material was reworked still further before it came to rest to form soil. The water from the melting ice picked up some of the smaller particles and carried them on. The varying velocities of streams and sheets of water sorted the material according to the size of the particles and laid the coarser ones down in beds of sand and gravel. The numerous sand and gravel pits in the State provide obvious examples of the results of this action. In this bulletin, we call this water-deposited, stratified material, *glacial outwash and river terraces.*

The very fine particles of silt and clay were carried further by the water, finally coming to rest in the quiet waters of ponds, lakes, and arms of the sea. These depressions became filled and the water receded, leaving beds of silt and clay, in places with a thin layer of fine sand over them. Many of the depressions were not completely filled with this type of material as evidenced by the numerous ponds and lakes in the State today. In a few cases, the water was shallow enough for plants to grow and as they died and fell, their remains accumulated to form deposits of muck and peat.

Even after the ice disappeared and the soil-forming processes started, there was some transportation of material by the post-glacial and present day streams. Each of these present day streams is building its river bottom, dropping material in some places and eroding it away in others. Much of the river bottom material has been deposited so recently that there hasn't been time for it to be as thoroughly acted on by the weather as the deposits which date back to the Ice Age.

All of the soil-forming processes have not acted to the same extent or in the same way on all of the soil materials. The ice and the water did not lay the material down uniformly, but deposited some of it in knolls and hollows. Some of the hollows held water; in other depressions, the ground water table was close to the surface and the deposited material was waterlogged for all or part of the year. Some of the knolls are so gravelly and open that they hold practically no available water. The soils of the State may therefore be divided into: (1) those formed under well-drained conditions, (2) those formed under permanently waterlogged conditions, and (3) those which are wet at times but dry at others. These conditions affected the kind and intensity of the soil-forming process and as a result the soils are quite different in character from place to place.

Even if artificially drained by ditches or tile, a soil formed under waterlogged conditions is not the same as one formed from the same materials on a well-drained knoll.

Much of New Hampshire is composed of granite which gave rise to coarse textured soils, usually sands and sandy loams. Along the western side and across the southern part of the State are belts of schist. Soils formed from this type of rock material contain more fine particles and are frequently classified as loams.

All New Hampshire soils have been classified and mapped by soil series and soil types. A soil series is a particular kind of soil which is given the geographic name where it was first defined. An example of a soil series is Colebrook, named after a town in northern New Hampshire.

The Colebrook series, for example, occurs over a wide area and contains several different surface textures such as loamy fine sand and fine sandy loam. When the series name Colebrook is attached to the name of the surface texture, the resulting name is a soil type, such as Colebrook fine sandy loam.

Generalized Soil Association Map

The Generalized Soil Association Map[1] of the State (Figure 8) shows six areas which are characterized by certain kinds of soil. Actually, each area contains many individual areas of soil but they are too small to show on a map of this scale. Figure 8A shows the location of county agricultural offices.

Area 1 (brown). Hermon-Berkshire-Rockland (mountainous), which includes most of the northern half of the State, is characterized by stony and very stony soils on glacial till, which are frequently shallow to bedrock. It is also characterized by cool weather and a short growing season. This section includes the White Mountains and other steep, hilly land in the foothills. Most of the soils are naturally well-drained, largely Soil Management Groups 10, 11, 29, 30, and 31.[2]

Area 2 (red), Berkshire-Charlton-Whitman, consists of several disconnected areas of glacial till where schist has been an important part of the soil-forming material. Schist breaks down readily into fine particles, and the soils formed from it are largely of loam and very fine sandy loam textures. The largest block of this material is in a belt along the Connecticut River, but other areas are scattered across southern New Hampshire. It contains soils which are mostly in Soil Management Groups 1, 3, 4, 7, and 10.

Area 3 (yellow), Hermon-Gloucester-Whitman, making up most of the southern half of the State, is an area of glacial till mainly from granitic rock, which gives rise to sandy loam and fine sandy loam soils. This area dominantly consists of Soil Management Groups 2, 3, 5, 10, and 29.

Area 4 (green), Colton-Merrimac-Sudbury, consists of soil formed from beds of loose sand and gravel. The land is usually quite level. Although the

[1] Adapted from more detailed Soil Association Map prepared by Walter H. Lyford, Soil Surveyor, Agronomy Department, University of New Hampshire.

[2] Soil Management Groups are discussed in Chapter IV, Soil Management Groups and Crop Adaptations, and in Appendix B.

soils are found in all parts of the State. they are most common in the southeastern quarter. and include Soil Management Groups 12 to 17.

Area 5 (purple). Scantic-Merrimac-Hollis. is a mixed area near the coast. It contains patches of fine sandy loam and loam soils from glacial till. from both schist and granite (mostly Groups 1 to 11): sandy soils on bedded sand and gravel (mostly Groups 12 to 17); and silt loams from materials laid down in ponds or in arms of the ocean (mostly Groups 23 to 28).

Area 6 (blue). Ondawa-Hadley-Podunk. consists of soils formed on river bottoms. These soils occur in narrow bands along streams in all parts of the State. Because of the scale. only the larger areas are shown on the map and are represented by Soil Management Groups 18 to 22.

Soil Erosion

Since the white man came into the State and started clearing the forest from the land. some soil erosion has taken place. The removal of soil by water or wind is not extensive over the State as a whole. Where it does occur. it is a serious problem. The soils of New Hampshire are not as erodible as those in some other parts of the country. Most of the land in the State has a protective cover of trees or grass which reduces the hazard. Also, for four or five months during the winter, the ground is protected by either being frozen or by a snow cover.

Most sloping areas that have been used for crop production have suffered some loss of soil. On these farms where the soil has been intensively used, erosion is a serious problem. In general. however. erosion has not yet caused severe damage to most fields, but if sloping fields remain in cultivation they should be protected by sound conservation measures to prevent

Soil Conservation Service

This shows erosion on a sloping field that has been intensively cultivated.

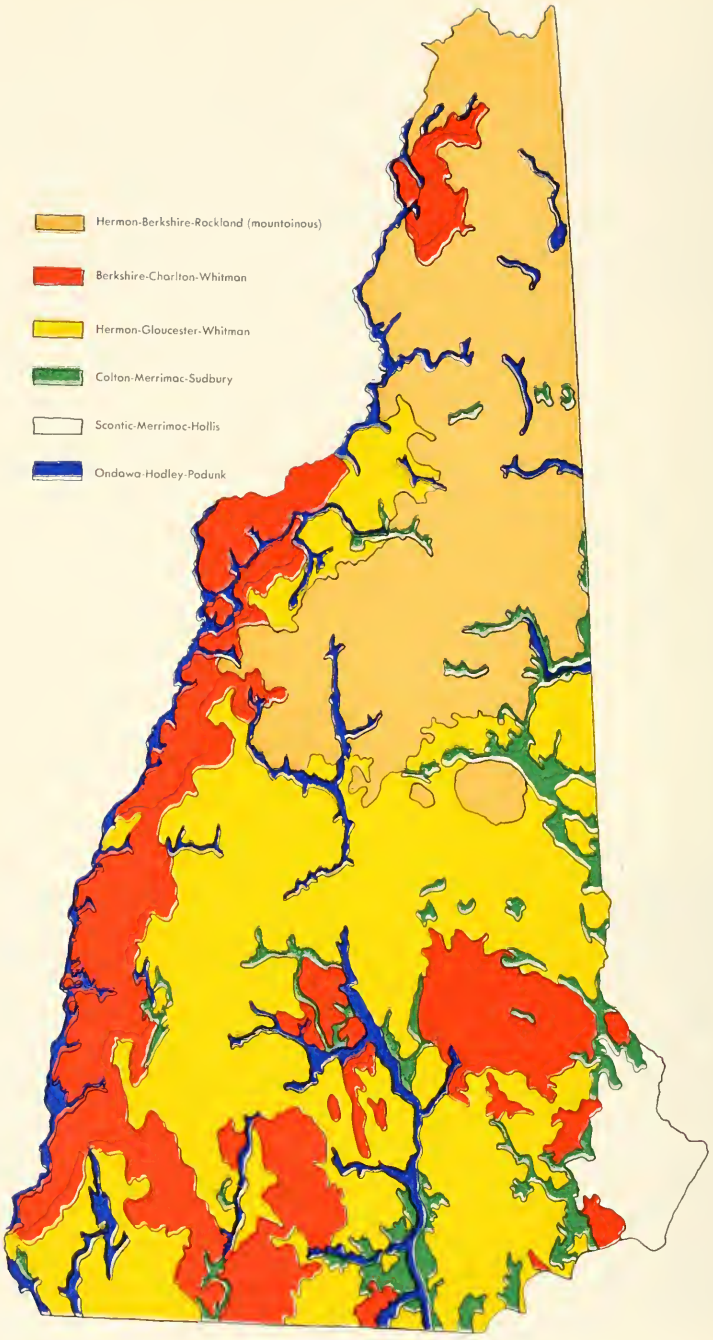


Figure 8. A Generalized Soil Association Map of New Hampshire.

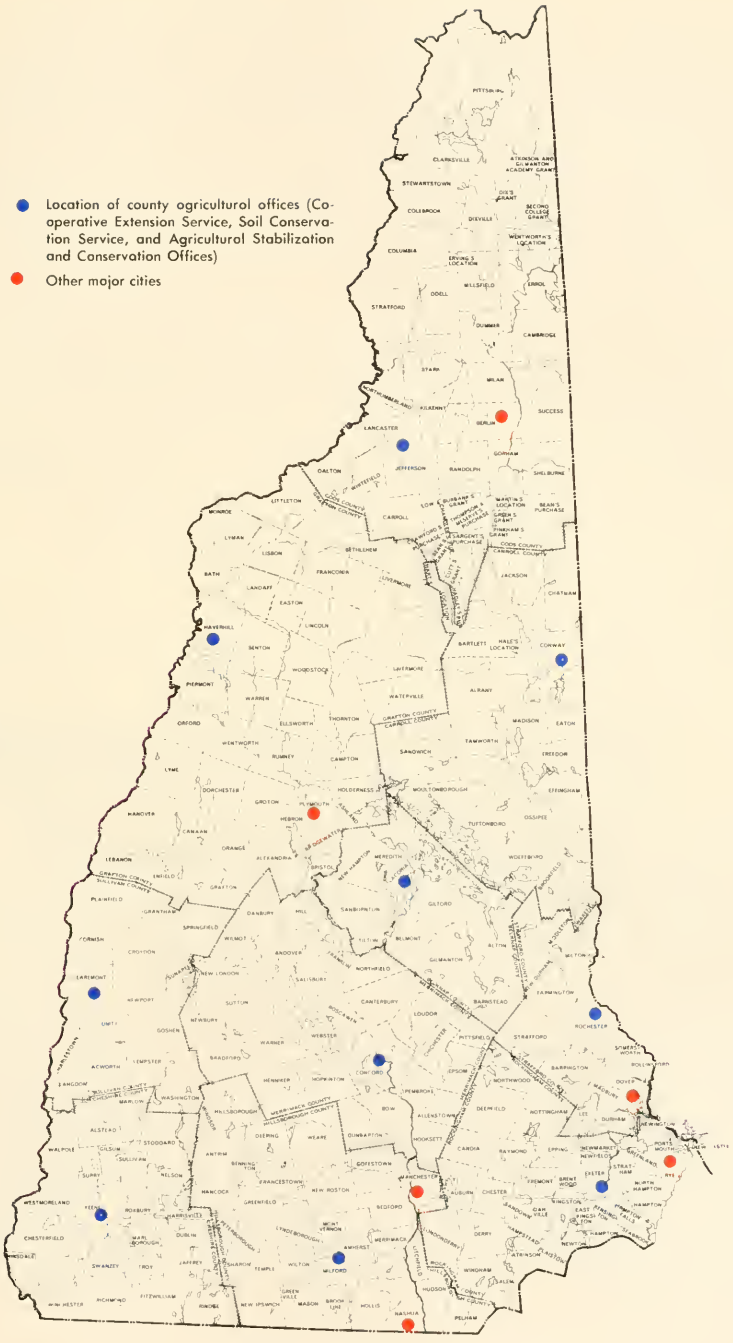

Location of county ogricultorol offices (Cooperative Extension Service, Soil Conservation Service, and Agricultorol Stabilization and Conservation Offices)
Other mojor cities

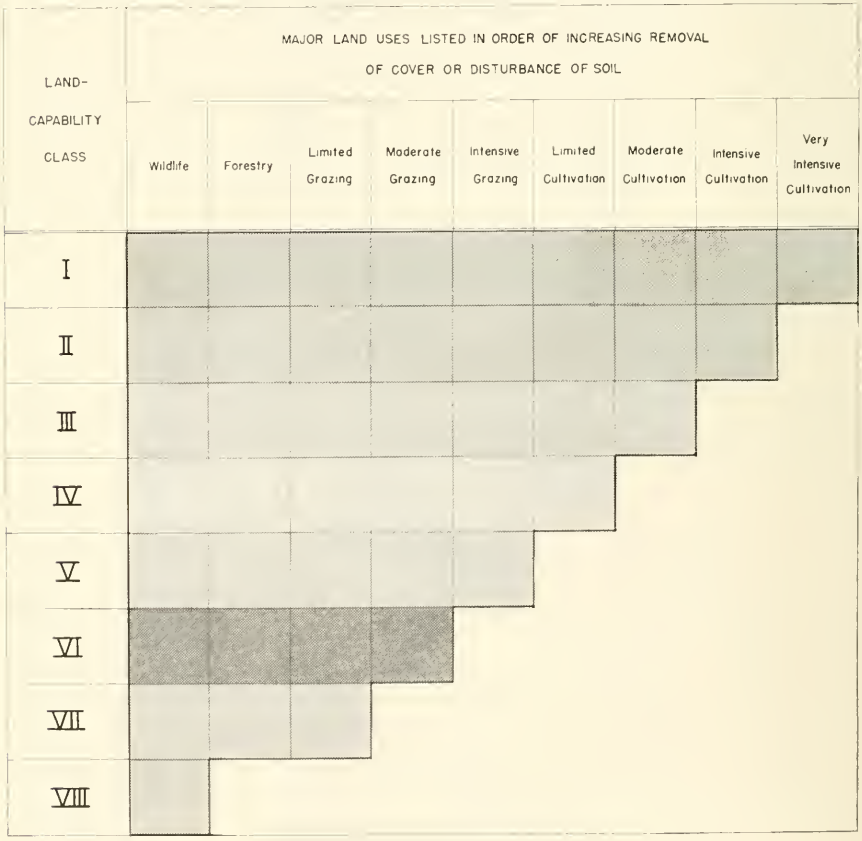
Figure 8A.

destructive erosion. Streambank erosion is a very serious problem over the State because it affects very productive land either by direct loss of soil or through deposition of infertile soil material. Possibly the most spectacular erosion in the State is along the sides of the Connecticut Valley where huge gullies have been cut by water flowing from the upland to the river. Woods roads and animal trails on steep slopes are important causes of gullying.

The principal factors that contribute to wind and water erosion are: bare land, intensive cultivation, cultivation up and down the slope, steep slopes, long slopes, intensity of rains, rapid snow melt, frost, strong winds, and drought.

One condition that occurs frequently in New Hampshire is that in the spring in open areas the frost melts to a depth of a few inches, but below this the ground is still frozen. This frozen layer will not take in water, so when it rains or the snow melts, the surface soil becomes extremely wet. In this condition the soil is easily eroded by running water.

RELATION OF LAND-CAPABILITY CLASSES TO SAFE LAND USE



UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Figure 9.

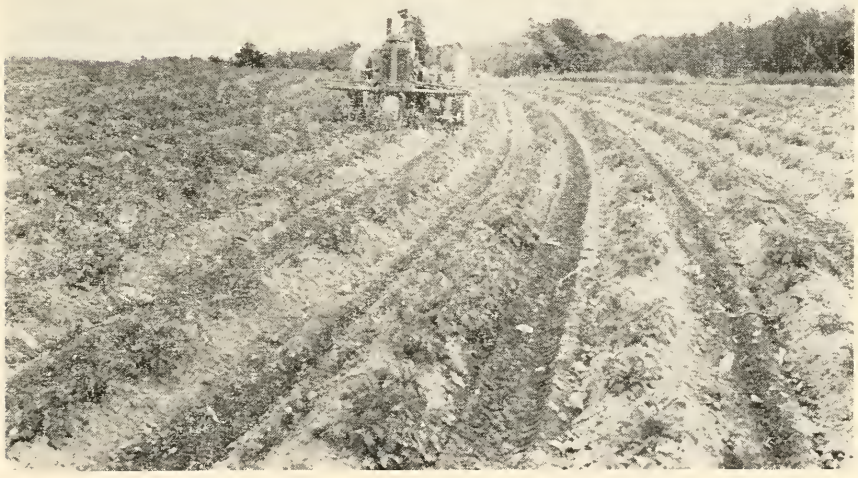
Land-Capability Classes

We may group the soils of the State into various classes according to ways in which they may be used safely. Some land may be suited to cropping; other land may be best used for forestry or for wildlife and recreation. It may be safe to farm some cropland intensively; other areas, although productive, may have certain limitations, such as steepness of slope or an erodible type of soil, which require the use of special conservation practices if the land is to be properly used. One of the major uses of the soil survey data is to provide a physical inventory of the land which can be interpreted into land capability classes that form the basis of a sound soil and water conservation program.

The following is a national classification system established by the Soil Conservation Service to show the relation of capability groups of soils to safe land use. It is the same classification that is used on the soil maps that serve as a basis for planning individual farms. (Figure 9.)

Class I. Land suitable for all uses. Very intensive cultivation requires only good soil management practices. The soils are deep and productive. The land is nearly level and there is little or no erosion.

Class II. Suitable for all uses, but intensive cultivation requires *simple* conservation practices. Gently sloping land needs contouring and strip cropping. Moist land needs improved drainage. The soils are deep and productive but need liming, manuring, and fertilizing.



Soil Conservation Service

A simple conservation practice for Class II type of land is contour tillage.

Class III. Suitable for all uses, but moderate cultivation requires *intensive* conservation practices. For example, moderately sloping land is in need of diversions and contour strip cropping. The soils are productive but need rotations that limit the years of clean tilled crops to approximately one year out of three.

Class IV. Suitable for all uses when cultivation is *limited* to one year of row crops when reseeding hay or pasture lands. Additional protective measures are needed on strongly sloping land. Wet lands need improved drainage. This class is best suited to pasture or hay.

Soil Conservation Service

This is an example of Class IV land which is best suited for pasture or hay.

Class V. Suitable for *intensive* pasture use, or woodland and wildlife. When used for pasture, requires only good management. This class is not used at present in New Hampshire.

Class VI. Suitable for *moderate* pasture use, or woodland and wildlife. This steep or stony land requires good management for optimum pasture use.

Class VII. Suitable for *limited* grazing, or woodland and wildlife. These shallow, very stony, or very steep slopes should be maintained in permanent woodland cover for maximum protection.

Class VIII. Suitable in some cases for wildlife production and recreation. Areas of rock outcrop and coastal beach are in this class.

The slope classes, shown by letters or as phases on soil survey maps, are a major factor in interpreting land capability classes. The slope classes are as follows:

A. Level to nearly level (0 - 3 percent)
B. Gently sloping (3 - 8 percent)
C. Moderately sloping (8 - 15 percent)
D. Strongly sloping (15 - 25 percent)
E. Steeply sloping (25 - 35 percent)
F. Very steeply sloping (35 percent or more)

Recent soil surveys in the State show that the land in New Hampshire is divided approximately as listed in Table 2.

Table 2. Precentage of Land Surveyed, by Land-Capability Classes in New Hampshire*

Land Capability Class	% of Land in Each Class
Class I	3.2
Class II	8.8
Class III	8.5
Class IV	3.1
Class V	—†
Class VI	38.9
Class VII	37.2
Class VIII	0.3
Total All Classes	100.0%

* Based upon approximately 1,200,000 acres of measured soil survey data.
† There is no Class V used at present in this State.

Table 2 shows that there is only 3.2 percent of our land which is sufficiently level, with deep, well-drained, uneroded soil to be in Class I, while 76.4 percent is in Classes VI, VII, and VIII and cannot safely be used for cropland.

The present use of land in these classes in New Hampshire is approximated in Table 3.

Table 3. Percentage of Present Use of Land, by Land-Capability Classes in New Hampshire

Class	Cropland	Pasture	Woodland	Idle†
	%	%	%	%
I	72.6	10.4	11.7	5.3
II	54.4	12.1	24.7	8.8
III	32.2	11.1	48.9	7.8
IV	33.4	15.8	39.1	11.7
V*	—	—	—	—
VI	1.9	9.0	85.6	3.5
VII	0.5	3.5	94.3	1.7
VIII	1.5	1.3	27.2	70.0

* There is no Class V used at present in this State.
† Includes idle farm land, miscellaneous uses, and urban areas.

It can be seen in Table 3 that most of the Class I land is used for cropland. Classes VI and VII, on the other hand, are dominantly in woodland. Most of class VIII land is idle.

IV. Soil Management Groups and Crop Adaptations

THE SOIL surveys show a total of more than 200 different soil types recognized and mapped in the State (Appendix A, page 80). The differences between some of these are not highly significant in a discussion of the broad uses and treatment of the land, however, and for the purposes of this bulletin, the soils may be combined into five groups with different geologic origins which include 36 Soil Management Groups. The five broad subdivisions based upon geologic origin are:

(1) Glacial uplands
(2) Glacial outwash and river terraces
(3) River bottoms
(4) Marine and lacustrine materials
(5) Miscellaneous materials

Under each of these five broad subdivisions there are from 5 to 11 Soil Management Groups which are discussed separately in relation to their crop adaptations.[1] You will note that crop adaptations are similar in some Soil Management Groups, which would suggest that a reduction could be made in the number of Management Groups. However, for the purposes of this bulletin it was believed that separate Management Groups by geologic origin would be fundamental for all present and predicted future uses. Other uses may be made of these fundamental soil groupings by new combinations designed to meet a specific objective, such as for irrigation, drainage, forestry, or engineering soil mechanics.

Soils Developed on Glacial Uplands

ABOUT 83 percent of the State is covered with moderately coarse- to medium-textured soils of glacial till (uplands). These soils are formed on unsorted materials containing particles of all sizes — from clay to boulders — but sand and stones predominate. This material is quite uniform in texture at all depths. Bedrock lies at varying depths and outcrops of bedrock are common. Except on steeper slopes, however, most of the material is from 3 to 10 feet or more in thickness over bedrock, and this provides enough soil for plants to anchor themselves and to get the necessary water and nutrients.

About half of this area is very stony and is suitable primarily for forestry and for wildlife and recreation. Much of the remainder is too stony for cultivation but is suitable for pasture or for forestry with proper conservation practices. On some of this land, the number and size of surface stones would permit clearing without too much expense. Only 11 percent of the acreage on glacial till is free enough of stones that it can be cultivated regularly for crops or used for improved pasture. This rel-

[1] See Appendix B for a complete list of Soil Management Groups and their soil types.

Soil Conservation Service

The removal of stones on glacial upland soils is often an economic practice.

atively stone-free condition is true of the surface soil only, and is the result of stone clearing activities carried on by generations of farmers. The soil material is still stony below plow depth.

Most of the soils on glacial till are classified as fine sandy loams and loams, although small acreages of sandy loam and silt loam soils have been mapped. All of them are easily plowed and cultivated where they are not too stony or wet. The sandy loam areas, usually found on granitic materials, are inclined to be droughty, but the fine sandy loams and loams contain enough fine particles of silt and clay to retain moisture for plant use and to hold nutrients against excessive loss by leaching. The sandy loams and loams are open enough to permit excess water to move through them readily, so most of them are classified as well drained. The soils formed on schist materials in most places are loams and are considered better agricultural soils.

There is considerable acreage of glacial till soils that are underlain by a compact, hard layer which restricts the downward movement of water and makes them less subject to drought. These soils occur frequently on long, low ridges.

The glacial soils are not naturally highly fertile, but they provide conditions under which the ordinary farm crops respond readily to applications of commercial fertilizers. The soils are low in phosphorus and available potash, and legumes may require the addition of a little boron. Many of the soils from schist appear to contain a little more lime than those from granite, but all of the glacial till soils are acid enough to require the addition of lime for clover and alfalfa. The magnesium content is low enough that dolomitic (magnesium) limestone is usually recommended in preference to calcic limestone.

All of the commonly grown crops in the State, including fruit, vegetables, potatoes, corn, small grains, grasses and clovers, do well on these soils except where poor drainage or droughtiness interferes. Softwood trees grow well and so do the hardwoods. For these reasons, it is sometimes difficult to maintain pure softwood stands.

The soils from glacial till lie on a wide range of slopes, from a few nearly level areas to nearly vertical cliffs. Since the non-stony areas are the result of stone clearing activities, aimed at fitting the land for cultivation, most of them are on slopes suited to the use of modern farm implements. The average slope of the stony areas is somewhat steeper, but still within the range of present day logging methods. The very stony areas are frequently very steep also.

When sloping lands are used for cultivation, steps should be taken to prevent erosion, even though these soils may not be extremely susceptible to erosion. The need for such protective practices as strip cropping, diversion terraces, and gully control measures is greater as slopes become steeper or cultivation becomes more intensive. The soils will gully readily when the water which falls on them collects into streams. For this reason, woods roads dug out of the hillsides, are frequently severely gullied and the discharge of water from poorly located or unstabilized woods roads seriously erodes areas where the discharge concentrates.

The soils developed on glacial uplands are divided into eleven Management Groups (1-11) as follows:

1. Deep, well-drained over moderately firm till.
2. Deep, well-drained over loose till.
3. Deep, well-drained over compact till.
4. Moderately deep, well-drained over bedrock (occasional rock outcrop).
5. Shallow, well-drained (rock outcrops extensive).
6. Moderately well-drained over loose till.
7. Moderately well-drained over compact till.
8. Poorly drained till soils.
9. Very poorly drained till soils.
10. Stony, well- and moderately well-drained till soils over loose and compact till (includes also small stony areas in other than till soils).
11. Stony, poorly, and very poorly drained till soils.

Soil Management Group 1

BERKSHIRE LOAM
CHARLTON LOAM
COLRAIN LOAM
GREENSBORO FINE SANDY LOAM
GREENSBORO LOAM
NEWPORT LOAM

These deep non stony soils which developed on moderately firm, medium-textured glaical till are well drained. They retain enough moisture for optimum plant growth, but excess water seeps away readily. The moisture relations in these soils are good, and plants are affected by the lack of moisture only if the duration of the drought period is very long. The topography is gently rolling to slightly hilly, and practically all the land is cultivated. Many prosperous farms are situated on these soils, and when they are adequately fertilized and managed, good yields can be expected. When these soils occur on long slopes, it is necessary to provide adequate conservation measures to protect the soil from excessive soil and water loss. A concentration of

truck crops and apple orchards may be found on this soil management group in the town of Hollis, New Hampshire, and vicinity, indicating the agricultural potential that can be realized.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	None	None
Truck Crops*		
Orchards		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 2

Acworth loam
Brookfield fine sandy loam
Brookfield loam
Gloucester sandy loam
Gloucester fine sandy loam
Gloucester loam
Grafton loam
Hermon sandy loam
Hermon fine sandy loam
Newmarket loam

These deep non-stony soils developed on loose, fairly coarse-textured glacial till are all well drained. Water moves through them rapidly, and they retain less moisture for plants than the soils in Group 1. They have a tendency to be more droughty than the well-drained soils which developed on medium-textured glacial tills; therefore, plants on these soils will show the effects of a lack of moisture during shorter periods of drought.

A large share of the acreage of non-stony glacial till soils in New Hampshire is found in this group. The topography is commonly rolling to hilly, which makes it necessary to protect these areas with proper soil management and conservation measures to maintain their productivity.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	None	None
Truck Crops*		
Orchards		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 3

Becket loam
Blandford loam
Essex loam
Marlow loam
Paxton loam

These moderately deep, non-stony soils underlain by compact, platy, medium-textured glacial till are all considered in the well-drained category, although the compact layer slows up the downward movement of water to an appreciable extent. The surface and subsoil are saturated early in the spring, remain quite moist for a longer period of time after a heavy rainfall, and are ready for tillage operations a little later than the other well-drained upland soils. This is due to the fact that water percolates very slowly through the compact layer. These soils occupy the smoother areas of glacial till and are usually found on oval-shaped hills. The very nature of the compact layer leads to seepage spots on the lower slopes, because most of the water does not enter the compact layer but moves along the top of it to create a management problem for the farmer. However, the compact layer is very favorable for providing the moisture and nutrient requirements needed by a wide variety of crops. For these reasons, the soils form the basis of our most stable and productive agriculture on the upland, when proper attention is given to soil and water conservation practices. At the present time approximately two-thirds of the acreage of these soils is used for growing crops.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	None	None
Truck Crops*		
Orchards		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations

Soil Management Group 4

BRIMFIELD LOAM
CANAAN SANDY LOAM
CANAAN FINE SANDY LOAM
CANAAN LOAM
COLRAN LOAM (Strafford County)
HOLLIS LOAM
LYMAN LOAM
ROCKINGHAM LOAM
SHAPLEIGH SANDY LOAM
SHAPLEIGH FINE SANDY LOAM
SHAPLEIGH LOAM
WESTMINSTER LOAM

These moderately deep soils have developed on glacial till which rests on bedrock at a depth of from 20 to 30 inches from the surface of the ground. They are all well drained, and water moves freely throughout the soil. Ledge outcrops occur but are not in sufficient number to prevent the use of the soils for cultivated crops. During the spring thaws and after periods of heavy rainfall, the surplus moisture moves down the slope on top of the bedrock and causes drainage problems on lower slopes. The major consideration from an agricultural standpoint of these soils is the shallowness of the soil over the bedrock. Naturally, in a shallow soil there will be poorer moisture relationships with more susceptibility to periods of dry weather, and fewer plant nutrients available for the growing crops. The variation in the depth to bedrock actually makes parts of a field more droughty than others. The above factors, plus the definite susceptibility to soil erosion when intensively cultivated, restricts the use of these soils to less intensive cropping systems. Only one-fourth of this acreage is used for crops.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
None	Corn	None
	Truck Crops*	
	Orchards†	
	Small Grains	
	Barley	
	Oats	
	Winter Rye	
	Winter Wheat	
	Grasses	
	Brome	
	Millet	
	Orchard	
	Redtop	
	Reed Canary	
	Timothy	
	Legumes	
	Alfalfa	
	Alsike Clover	
	Birdsfoot Trefoil	
	Ladino Clover	
	Red Clover	
	Soybeans	
	Winter Vetch	

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Orchards on these shallow soils would be subject to wind throw.

Soil Management Group 5

Brimfield ledgy loam
Brimfield stony loam
Brookfield stony loam, shallow phase
Canaan ledgy fine sandy loam
Canaan stony fine sandy loam
Canaan stony loam
Colrain stony loam (Strafford County)
Hollis ledgy loam
Hollis stony loam
Lempster stony loam
Lyman ledgy loam
Lyman stony loam
Rockingham ledgy loam
Rockingham stony loam
Shapleigh stony sandy loam
Shapleigh stony fine sandy loam
Shapleigh ledgy loam
Westminster ledgy loam

These shallow-to-bedrock soils have developed on the same type of parent material as the soils discussed in Group 4. The principal difference between the two soil groups is in the depth to underlying bedrock. The thin cover of soil over ledge in this group ranges between 10 and 20 inches, and the ledge outcrops are so numerous that the growing of cultivated crops, for all practical purposes, is not considered feasible. The poor moisture relationships or susceptibility to drought that was stressed in Soil Group 4 is much more serious in this group of soils, so that shallow rooted sod crops that can best withstand dry weather are recommended in areas that can be seeded.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
None	None	Corn
		Truck Crops*
		Orchards
		Small Grains
		Barley
		Oats
		Winter Rye
		Winter Wheat
		Grasses†
		Brome
		Millet
		Orchard
		Redtop
		Reed Canary
		Sudan
		Timothy
		Legumes†
		Alfalfa
		Alsike Clover
		Birdsfoot Trefoil
		Ladino Clover
		Red Clover
		Soybeans
		Winter Vetch

* Includes potatoes: specific vegetables will have somewhat varying adaptations.

† Any seedings on these soils should be limited to small areas of deeper soil between the outcrops. In the deep areas, crops as listed for Soil Management Group 4 can be used. Encourage bluegrass and wild white clover to volunteer by liming, manuring, and fertilizing.

Soil Management Group 6

Acton loam
Peru loam
Sutton loam
Sutton silt loam
Waumbek loam
Waumbek-Peru-Acton loams

These moderately well-drained, non-stony soils have developed from glacial till that ranges in texture from coarse to medium.

Moderately well-drained soils are wet in the spring and fall and for a time after heavy rains. They occupy slight depressions and nearly flat areas at the foot of slopes. These depressional areas and lower slopes are kept wet in most cases by drainage of excess moisture from higher lying soils. This provides for a temporary high water table during wet periods and a fairly moist condition throughout the growing season. The temporarily saturated condition limits the movement of water and air throughout the soil, which is so vital for crop growth. In a dry season, crops on these soils usually do not suffer from a lack of available moisture. Artificial drainage of these soils will definitely extend the range of crops that can be grown, but these areas may occur in small nuisance spots where the cost of drainage is excessive for the benefits derived.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Alfalfa
Winter Wheat	Barley	Winter Vetch
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

II Artificial Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Corn	Orchards†	None
Truck Crops*	Legumes	
Small Grains	Alfalfa	
Barley	Winter Vetch	
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

† Topographic position usually poor for good air drainage.

Soil Management Group 7

Scituate loam
Skerry loam
Woodbridge loam
Woodbridge silt loam

This moderately well-drained group of non-stony soils differs significantly from Group 6 in that the soils have developed on a compact, platy, medium-textured glacial till found at a depth of approximately 20

inches. Water moves freely through the upper part of the soil above the compact layer, but movement is severely restricted in the compact layer. Water tends to flow laterally over the compact layer, resulting in seep spots on the lower slopes. Any artificial drainage considered for these soils should be based upon the interception of the excess water above the compact layer and the safe disposal of it so as not to create another drainage problem.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Alfalfa
Winter Wheat	Barley	Winter Vetch
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan	Soybeans	
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

II Artificial Drainage Condition
(Drainage should intercept water flowing on compact layer)

Well Adapted	Intermediate	Poorly Adapted
Corn	Orchards†	None
Truck Crops*	Legumes	
Small Grains	Alfalfa	
Barley	Winter Vetch	
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes: specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor for good air drainage.

Soil Management Group 8

LEICESTER LOAM RIDGEBURY LOAM

This group consists of the poorly drained, non-stony glacial till, regardless of the nature of the parent material. It lies on level areas or in slight depressions. The water that falls on these soils or drains into them from other higher lying soils may form a temporary pond. This high water table exists throughout most of the growing season. In fact, the soils are usually saturated to within about 1 foot of the surface for extended periods each year. This saturated condition severely restricts plant growth. Agricultural uses of the soils vary according to whether they are used in their natural drainage condition or whether artificial drainage is installed to lower the water table. Drainage problems on these soils are very complex and require detailed investigations before a decision can be made. Artificial drainage should be installed only if the increased yields of crops would be sufficient to justify the cost.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

II Artificial Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Winter Rye	Truck Crops*	Small Grains
Grasses	Small Grains	Barley
Brome	Oats	Legumes
Redtop	Winter Wheat	Alfalfa
Reed Canary	Grasses	Winter Vetch
Legumes	Millet	
Alsike Clover	Orchard	
Birdsfoot Trefoil	Sudan	
Ladino Clover	Timothy	
	Legumes	
	Red Clover	
	Soybeans	

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 9

WHITMAN LOAM

This group consists of the very poorly drained, non-stony glacial till soils, regardless of the nature of the parent material. The severely limiting factor in this case is the presence of an excess of water which keeps the soil saturated at the surface most of the year, and the value to agricultural production under natural conditions is very low. Only in very special cases would artificial drainage be recommended. About one fourth of the area is used for cropland at the present time because of the poor natural drainage.

Major Crop Adaptations

I NATURAL DRAINAGE CONDITION

Well Adapted	Intermediate	Poorly Adapted
None	Grasses Reed Canary	Corn Truck Crops* Orchards Small Grains Barley Oats Winter Rye Winter Wheat Grasses Brome Millet Orchard Redtop Sudan Timothy Legumes Alfalfa Alsike Clover Birdsfoot Trefoil Ladino Clover Red Clover Soybeans Winter Vetch

II Artificial Drainage Condition
(Only special conditions recommended for drainage)

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 10

Acton stony loam
Acworth stony loam
Becket stony loam
Berkshire stony loam
Brookfield stony fine sandy loam
Brookfield stony loam
Charlton stony loam
Colrain stony loam
Colton stony gravelly fine sandy loam
Danby stony loamy fine sand
Danby stony gravelly fine sandy loam
Essex stony loam
Gloucester stony sandy loam
Gloucester stony fine sandy loam
Gloucester stony loam
Grafton stony loam
Greensboro stony loam
Hermon stony sandy loam
Hermon stony fine sandy loam
Hermon stony loam, hardpan phase
Hinckley stony gravelly fine sandy loam
Marlow stony loam
Merrimac stony loamy sand
Newmarket stony loam
Paxton stony loam
Peru stony loam
Scituate stony loam
Skerry stony loam
Suffield stony silt loam
Sutton stony loam
Waumbek stony fine sandy loam
Waumbek stony loam
Waumbek-Peru-Acton stony loams
Woodbridge stony loam
Woodbridge stony silt loam

This group consists of all the stony, well-drained and moderately well-drained upland soils. The presence of sufficient stones to seriously interfere with the use of farm machinery under modern farming methods is the significant limiting factor in this soil group. The requirements of the farm enterprise will determine whether it would be economically feasible to clear the stones from the fields. In the event that the stones are removed, the agricultural uses of the cleared areas would be the same as those listed for the similar non-stony soil types.

Major Crop Adaptations

I Present stony condition —
Permanent pasture (native volunteer bluegrass and wild white clover).

II After stone removal —
See Soil Management Group for the particular non-stony soil types involved.

Soil Management Group 11

WHITMAN STONY LOAM

This group consists of the poorly and very poorly drained, stony upland soils. Again, as in the case of Soil Management Group 10, the stones are the major limiting factor on use for agricultural purposes. However, the poor drainage that exists along with the stoniness, limits to a great extent any economic value from stone removal, except in special cases. Where stone removal is carried out, follow the recommendations on agricultural uses given under the similar non-stony soil type.

Major Crop Adaptations

I Present stony and natural drainage condition —
Reed Canarygrass (broadcast if feasible).

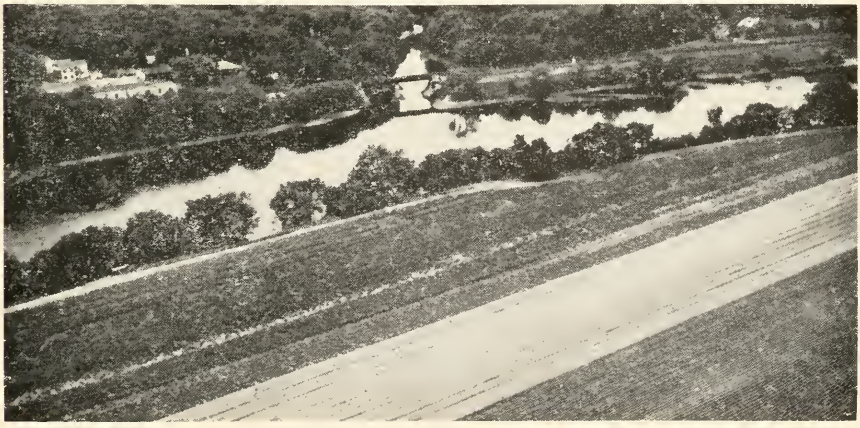
II After stone removal (if economically sound)
See appropriate Soil Management Group for the particular non-stony soil type involved, with recommendations for natural and artificial drainage conditions.

Soils Developed on Glacial Outwash and River Terraces

NEARLY 10 percent of the State is covered with deposits of bedded sand and gravel. Some of the beds are of deep fine sand; others are of loose, open gravel with some sand between gravel and cobbles; while still others consist of alternating layers of sand and coarse gravel. The character of the soil which has formed on these parent materials is dependent on the nature and thickness of the surface layer. As a result, some of the surface soils are almost pure sand, others are gravelly, while still others are fine sandy loams. Practically none of these deposits is stony.

These areas are found in all parts of the State but are more common in the southeast quarter and along the Connecticut River.

Soil surveys covering about two fifths of the soils in the State show that very little of this kind of land is steep, except where streams have cut



Soil Conservation Service

An example of a river terrace on the Merrimack River, Hillsborough County.

valleys through it and formed steep banks on either side. More than one-third of the acreage of these soils is on level or nearly level land, and another third is only gently sloping. Nearly one third of the level land has the water table close enough to the surface to classify the land as having poor to very poor natural drainage. More than two fifths of the soils are very sandy or gravelly, making them too droughty for use as ordinary cropland or for pasture production, although they are better suited to the growth of pine. Only one fourth of the land has no impeded natural drainage but still has a medium-textured soil which will hold sufficient moisture for good plant growth.

These Soil Management Groups comprise one half of the cropland found on the outwash materials: yet this land is not free of limitations. The presence of bedded sand and gravel within three or four feet of the surface makes them more subject to drought than the neighboring upland soils. Even with their gentle slope and their freedom from stone, they are not used for cropland to the same extent as the stone-cleared soils on glacial till.

The soils developed on glacial outwash and river terraces are divided into six management groups (12-17) as follows:

12. Deep, very excessively drained loamy sands and sands.
    a. Fine sands
    b. Coarse sands and gravelly sands
13. Deep, excessively drained sandy loams.
    a. Over beds of sand
    b. Over stratified gravel and sand
14. Deep, well-drained fine sandy loams.
    a. Over beds of sand
    b. Over stratified gravel and sand
15. Moderately well-drained sandy and fine sandy loams over sands and gravel.
16. Poorly drained sandy and fine sandy loams over sands and gravel.
17. Very poorly drained sandy and fine sandy loams.

Soil Management Group 12

Adams loamy sand
Adams loamy fine sand
Agawam loamy fine sand
Barnstead loamy sand
Colebrook loamy fine sand
Colton loamy sand
Colton loamy fine sand
Danby gravelly loamy sand
Danby loamy sand
Danby loamy fine sand
Dixville loamy fine sand
Groveton loamy fine sand
Hinckley gravelly loamy sand
Hinckley loamy sand
Hinckley loamy fine sand
Jaffrey loamy sand
Melrose loamy sand
Merrimac gravelly loamy sand
Merrimac loamy sand
Merrimac loamy fine sand
Nashua loamy sand
Nashua loamy fine sand
Windsor sand
Windsor fine sand
Windsor loamy fine sand

These deep sandy soils are very droughty. The underlying parent material consists of stratified beds of gravel and sand. (Gravel is absent in some cases, and the underlying material consists of varying sizes of sand.) These soils were formed from materials deposited by water. A few areas may be subject to overflow in case of extremely high water. Due to the very coarse sandy and gravelly character of these soils, water moves very rapidly throughout both the upper part of the soil and the underlying material. Where the soil is a fine sand, it has a better moisture relationship than the coarse sands or gravelly soils. Agriculturally, they are considered to have low potential, due mainly to the poor moisture relationship and to a low capacity for holding plant nutrients. Soil building rotations are a necessity when farming these soils. Irrigation is a possibility to improve the moisture relations, but more lime, fertilizers, and organic matter should be supplied when irrigated.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
None	Small Grains	Corn
	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Millet	Barley
	Orchard	Oats
	Redtop	Winter Wheat
	Sudan	Grasses
	Legumes	Reed Canary
	Alfalfa	Timothy
	Red Clover	Legumes
	Winter Vetch	Alsike Clover
		Birdsfoot Trefoil
		Ladino Clover
		Soybeans

II Irrigated Condition

(Irrigate better soils if available, as this group requires the highest volume of water and the greatest amount of fertilizer)

Well Adapted	Intermediate	Poorly Adapted
Corn	Small Grains	Orchards†
Truck Crops*	Winter Rye‡	Small Grains
Small Grains		Winter Wheat‡
Barley		
Oats		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birds-foot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes: specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor.
‡ Winter season crops do not need irrigation.

Soil Management Group 13

Barnstead sandy loam
Colton gravelly sandy loam
Colton sandy loam
Danby gravelly sandy loam
Danby gravelly fine sandy loam
Danby fine sandy loam
Dixville gravelly fine sandy loam
Dixville fine sandy loam
Hinckley gravelly sandy loam
Hinckley gravelly fine sandy loam
Hinckley fine sandy loam
Jaffrey gravelly sandy loam
Merrimac gravelly sandy loam
Merrimac sandy loam

These deep sandy soils differ from Group 12 in that they contain more fine material (silt and clay) and are not as droughty. The moisture relationships are not the best, however, for crops definitely suffer during dry weather. The parent materials of these soils were water-deposited during geologic times, but they are not generally subject to overflow from present-day streams. Water moves through the soils very rapidly. This Soil Management Group is slightly better for crops than Group 12. Crop rotations should be fairly short on these soils. They can be improved by soil-building crops as an aid in providing organic matter to increase their productive capacity. Irrigation possibilities should be investigated to provide better moisture relations.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
None	Corn	None
	Truck Crops*	
	Orchards‡	
	Small Grains	
	Barley	
	Oats	
	Winter Rye	
	Winter Wheat	
	Grasses	
	Brome	
	Millet	
	Orchard	
	Redtop	
	Reed Canary	
	Sudan	
	Timothy	
	Legumes	
	Alfalfa	
	Alsike Clover	
	Birdsfoot Trefoil	
	Ladino Clover	
	Red Clover	
	Soybeans	
	Winter Vetch	

II Irrigated Condition

Well Adapted	Intermediate	Poorly Adapted
	Orchards‡	
Corn	Small Grains	None
Truck Crops*	Winter Rye†	
Small Grains	Winter Wheat†	
Barley		
Oats		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Winter season crops do not need irrigation.
‡ Topographic position usually poor.

Soil Management Group 14

ADAMS FINE SANDY LOAM
AGAWAM FINE SANDY LOAM
AGAWAM VERY FINE SANDY LOAM
BARNSTEAD FINE SANDY LOAM
COLEBROOK GRAVELLY FINE SANDY LOAM
COLEBROOK FINE SANDY LOAM
COLTON GRAVELLY FINE SANDY LOAM
COLTON FINE SANDY LOAM
GROVETON FINE SANDY LOAM
GROVETON VERY FINE SANDY LOAM
MERRIMAC GRAVELLY FINE SANDY LOAM
MERRIMAC FINE SANDY LOAM
NASHUA FINE SANDY LOAM
NASHUA VERY FINE SANDY LOAM
NASHUA LOAM
PETERBORO GRAVELLY FINE SANDY LOAM
WARWICK GRAVELLY LOAM

Soils in this group contain more very fine sand and silt than soils in Groups 12 and 13. For this reason, they are considered to represent the best of the water-deposited soils. These soils occupy areas well above the flood crests. The effects of dry periods will reduce the yields of crops growing on these soils, but with proper crop rotations and management, good yields may be obtained. The ease of tillage operations, coupled with the possibility of early planting dates, are important factors that make up in some measure for the shorter rotations and the susceptibility to damage from dry weather. Irrigation on these soils would return the best yields for the investment if sufficient water, lime, fertilizer, and organic matter are supplied.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	Orchards†	None
Truck Crops*		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor for good air drainage.

Soil Management Group 15

DUANE FINE SANDY LOAM
NINIGRET VERY FINE SANDY LOAM
SUDBURY LOAMY SAND
SUDBURY FINE SANDY LOAM
SUDBURY VERY FINE SANDY LOAM
SUDBURY LOAM
SUDBURY SILT LOAM

These moderately well drained sandy soils occupy slight depressions, runs, and nearly flat areas at the foot of sloping land in the areas covered by the water-deposited soil materials. Only during times of extremely high-water are they subject to overflow. However, their natural drainage is affected by the temporary high water table that develops during periods of heavy rain or snow melt, even though the sandy material is rapidly permeable. This drainage condition restricts the use of farm machinery during wet weather and delays spring seeding to a slight degree. During relatively dry seasons the available moisture is adequate for crop production. In some cases artificial drainage may be feasible to allow more intensive use of these soils.

Major Crop Adaptations

I NATURAL DRAINAGE CONDITION

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards†
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Alfalfa
Winter Wheat	Barley	Winter Vetch
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan	Soybeans	
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

Well Adapted	Intermediate	Poorly Adapted
Corn	Legumes	Orchards†
Truck Crops*	Alfalfa	
Small Grains	Winter Vetch	
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

† Topographic position usually poor for good air drainage.

Soil Management Group 16

Saugatuck fine sandy loam — Walpole fine sandy loam

These poorly drained sandy soils are found in depressional areas in water-deposited soil materials where the high water table retards drainage during most of the growing season. The soils are usually saturated to within approximately one foot of the surface, but the sandy, porous nature of the soil responds well to artificial drainage. Severe limitations in use under natural drainage conditions may be moderated by artificial drainage so that a wider range of crops may be grown. Again, as in the case of Group 15, the permeability of the soil itself is rapid, but the high water table is the restricting factor rather than the permeability of the soil. A few areas of these soils have a cemented layer about 18 to 20 inches below the surface, which is an additional factor in keeping the soil saturated. On such soils, artificial drainage may improve the moisture conditions but should be carefully investigated to determine whether the results will justify the cost.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

II Artifical Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Winter Rye	Truck Crops*	Small Grains
Grasses	Small Grains	Barley
Brome	Oats	Legumes
Redtop	Winter Wheat	Alfalfa
Reed Canary	Grasses	Winter Vetch
Legumes	Millet	
Alsike Clover	Orchard	
Birdsfoot Trefoil	Sudan	
Ladino Clover	Timothy	
	Legumes	
	Red Clover	
	Soybeans	

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 17

Scarboro fine sandy loam Scarboro silt loam
Scarboro loam

These sandy soils occupy very poorly drained areas in the water-deposited materials. Again, the extremely high water table is the severe limiting factor for agricultural use. The soils are completely saturated during most of the year, but water which stands on the surface limits any agricultural activities to periods of extremely dry weather. Artificial drainage may be practical on some of these areas, depending upon (1) whether a good outlet can be found, and (2) whether the cost of drainage will be justified, either in increased yields or as a benefit to other areas of better soils. Even with artificial drainage, the use of these areas for crop production is definitely limited.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
None	Grasses Reed Canary	Corn Truck Crops* Orchards Small Grains Barley Oats Winter Rye Winter Wheat Grasses Brome Millet Orchard Redtop Sudan Timothy Legumes Alfalfa Alsike Clover Birdsfoot Trefoil Ladino Clover Red Clover Soybeans Winter Vetch

II Artificial Drainage Condition
(Only special areas recommended for drainage)

Well Adapted	Intermediate	Poorly Adapted
Grasses Reed Canary	Small Grains Winter Rye Grasses Brome Redtop Legumes Alsike Clover Birdsfoot Trefoil Ladino Clover	Corn Truck Crops* Orchards Small Grains Barley Oats Winter Wheat Grasses Millet Orchard Sudan Timothy Legumes Alfalfa Red Clover Soybeans Winter Vetch

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soils Developed on River Bottoms

About 4 percent of the land in the State is occupied by river bottoms. These occur in narrow bands along streams in all parts of the State. During geologic times, the material on these areas was sorted and deposited by the streams.

and the process is still going on. When the stream is swift, only the coarser particles are deposited as beds of coarse sand and gravel. When the current is slower, the stream lays down finer sediments of silt and clay along with fine sand. As the stream changes course and the speed of the current is increased or reduced at any one point, the character of the material deposited there will also change. As a result, the deposits at any one place consist of layers which vary in texture from sands to loams to silty clays which may occur at any depth. These stream bottoms are characterized by a level to very gently sloping surface, with only a few small areas of steeper land. Most of the material has been in its present location for too short a time for much weathering.

Most of the bottom lands lie only a few feet above the level of the streams, and for this reason the water table is close enough to the surface to reduce the possibility of drought. In fact, more than two fifths of the bottom land has a high enough water table to be classified as poorly to very poorly drained.

All of the area is subject to flooding, possibly not every year but often enough to produce some hazard in the use of the land for crops. A study of the data from partially completed soil surveys shows, however, that more than two thirds of the well-drained fine sandy loams are used for the production of field crops, including hay. This proportion increases on the land which lies too high to be flooded frequently. In parts of the Connecticut Valley, the soil material is finer textured and less acid, and as a consequence, the proportion of cropland is higher.

The soils developed on river bottoms are divided into five Management Groups (18-22) as follows:

18. Deep, very excessively drained loamy sands.
19. Deep well-drained fine sandy loams and very fine sandy loams (includes small areas of sandy loams).
20. Moderately well-drained sandy loams to silt loams.
21. Poorly drained fine sandy loams to silt loams.
22. Very poorly drained floodplain soils.

Soil Conservation Service

Soils developed on river bottoms are productive but are subject to flooding.

HADLEY LOAMY FINE SAND, LOW BOTTOM PHASE ONDAWA LOAMY FINE SAND
ONDAWA LOAMY SAND ONDAWA LOAMY FINE SAND, HIGH BOTTOM PHASE

These deep sandy soils are very open and droughty. The underlying material consists of beds of varying sizes of sand, mostly of granitic origin. Gravelly material is present in some cases. These soils were formed from materials deposited by our present streams. The lower lying areas are subject to frequent overflow during normal high water, although this usually occurs before spring seeding and after harvesting. The very coarse sandy character of these soils permits water to move freely throughout the upper part of the soil and the underlying material. Where these soil areas are only a few feet higher than the adjacent streams, the depth to the water table makes for a somewhat better moisture relationship than is found for similar soils lying at a much higher elevation above the streams. In their natural state, the very droughty condition puts them in the low potential bracket for agricultural production, although a little more than one fourth of this land is used for crops at the present time. Soil-building rotations are a necessity in farming these soils. The presence of streams adjacent to these soil areas provides the definite possibility of irrigation to improve the poor moisture relations. For irrigation to be profitable, the land must be limed, fertilized, and manured. Streambank erosion control is a major problem that needs careful consideration.

Major Crop Adaptations

I NATURAL DRAINAGE CONDITION

Well Adapted	Intermediate	Poorly Adapted
None	Small Grains	Corn
	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Millet	Barley
	Orchard	Oats
	Redtop	Winter Wheat
	Sudan	Grasses
	Legumes	Reed Canary
	Alfalfa	Timothy
	Red Clover	Legumes
	Winter Vetch	Alsike Clover
		Birdsfoot Trefoil
		Ladino Clover
		Soybeans

II Irrigated Condition (Irrigate better soils if available, as this group requires the highest volume of water. Lift for irrigation from water supply usually minor.)

Well Adapted	Intermediate	Poorly Adapted
Corn	Small Grains	Orchards†
Truck Crops*	Winter Rye‡	Small Grains
Small Grains		Winter Wheat‡
Barley		
Oats		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor.
‡ These winter growing crops do not need irrigation.

Soil Management Group 19

Hadley very fine sandy loam
Hadley very fine sandy loam, low bottom phase
Hadley very fine sandy loam, high bottom phase
Hadley silt loam
Ondawa sandy loam
Ondawa fine sandy loam
Ondawa fine sandy loam, high bottom phase
Ondawa very fine sandy loam
Ondawa very fine sandy loam, high bottom phase
Ondawa silt loam
Ondawa silt loam, high bottom phase

This group is the most productive of the floodplain soils. They are well-drained, medium-textured soils that hold moisture and nutrients fairly well, although excess water moves through them quite readily. During the periods of prolonged drought, crops on these soils, although with good moisture relations, will show the effect of lack of moisture sooner than those with similar texture on upland soils. The ease of tillage operations plus the availability of irrigation water makes these soils highly desirable for cultivated crops. The major hazard to more intensive cultivation is the very real danger of frequent overflow of the low-bottom phases during high water, although this occurs usually before seeding time and after harvesting. Near Litchfield, New Hampshire, where the growing season is about the longest in the State and the Merrimack River is pretty well under control, intensive vegetable growing is practiced on the high bottom phases of these soils. Streambank erosion control is a major problem with this Soil Management Group.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	Orchards†	None
Truck Crops*		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegatables will have somewhat varying adaptations.
† Topographic position usually poor.

Soil Management Group 20

PODUNK LOAMY FINE SAND
PODUNK FINE SANDY LOAM
PODUNK VERY FINE SANDY LOAM
PODUNK SILT LOAM
WINOOSKI FINE SANDY LOAM

These moderately well-drained sandy soils occupy slight depressions, runs, and nearly flat areas at the foot of terrace banks in the floodplains. The lower lying areas are subject to overflow during normal high water. But even if the rivers do not overflow their streambanks, the surface runoff and seepage from higher lying areas coupled with the high water table, will retard spring seeding and hinder the operation of farm machinery during wet weather. This temporarily saturated condition usually lasts for only a few days, since the porous soil permits excess surface water to seep away as soon as the water table falls enough to receive it. The crops planted on these soils will do very well during a dry year, due to the available moisture supply. Artificial drainage will improve the situation in normal years where it is feasible to install and will allow a wider variety of crops to be grown. More than half of the acreage of these soils is in cropland at the present time.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Alfalfa
Winter Wheat	Barley	Winter Vetch
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan	Soybeans	
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

II Artifical Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Corn	Legumes	Orchards†
Truck Crops*	Alfalfa	
Small Grains	Winter Vetch	
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor.

Soil Management Group 21

Limerick silt loam
Podunk-Rumney fine sandy loam
Podunk-Rumney silt loam
Rumney fine sandy loam
Rumney silt loam

These poorly drained sandy soils occupy depressions in the floodplains. The major limiting factor in the natural drainage of these soils is the high water table. The soils are saturated most of the year, and farm operations

are confined to periods when the land is dry enough to work. An added factor is that the normal high water that occurs from adjacent streams will back up into these depressions, keeping them covered with water for lengthy periods. This severely limits the agricultural uses of these areas. Artificial drainage may be practical on some of these areas, but the situations usually are rather complex and should be carefully investigated before attempting any costly drainage operations. The height above the stream is an important factor in making such drainage decisions. About one sixth of this Soil Management Group is used for crops.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

II Artifical Drainage Condition

(Very restricted possibility of drainage due to low position of these soils adjacent to streams)

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Winter Rye	Truck Crops*	Small Grains
Grasses	Small Grains	Barley
Brome	Oats	Legumes
Redtop	Winter Wheat	Alfalfa
Reed Canary	Grasses	Winter Vetch
Legumes	Millet	
Alsike Clover	Orchard	
Birdsfoot Trefoil	Sudan	
Ladino Clover	Timothy	
	Legumes	
	Red Clover	
	Soybeans	

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Alluvial soils, undifferentiated
Rumney-Saco soils
Saco fine sandy loam
Saco silt loam

These very poorly drained soils occur in depressions in the floodplain and are mainly sandy in texture; however, they include a few areas where silts were deposited. They also include other areas where the soil material and the natural drainage classes are so variable that no definite soil condition can be described, and the use of this land is limited by the frequency of poorly drained spots. The natural high water table and the overflow from the high water of adjacent streams combine to keep these areas saturated most of the year. The agricultural potential is very low, due to the very poor drainage condition. Artificial drainage in these areas is usually confined to outlets for the drainage of neighboring areas of better land.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
None	Grasses Reed Canary	Corn Truck Crops* Orchards Small Grains Barley Oats Winter Rye Winter Wheat Grasses Brome Millet Orchard Redtop Sudan Timothy Legumes Alfalfa Alsike Clover Birdsfoot Trefoil Ladino Clover Red Clover Soybeans Winter Vetch

II Artifical Drainage Condition
(Only special situations recommended for drainage)

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

* Includes potatoes; specific vegetabes will have somewhat varying adaptations.

Soils Developed on Marine and Lacustrine Materials

As streams flow into the quiet waters of ponds, lakes, or bays of the ocean, the rate of flow is decreased and the suspended sediments slowly settle to the bottom. Since much of the sand is deposited along the stream beds before reaching the ocean, these sediments laid down in quiet waters consist of the fine materials — fine sand, silt and clay, usually giving rise to silt loam plow layers. Changing currents and eddies lead to some sorting of these materials, so that pockets of sand may occur in the silt beds; and there is a small acreage where a thin layer of sand covers the silts. Practically all of the materials are non-stony.

Soil Conservation Service

These soils, developed on an old lake bed, have considerable silt and clay.

Soils from these materials cover only one percent of the State. Some of them are found in former pond sites scattered throughout the State, but the major acreage is in the lower part of Strafford and Rockingham Counties where the materials were laid down during geologic times in shallow bays of the ocean. Here the soils occur in a complex pattern, intermingled with soils from glacial outwash and glacial till.

As might be expected of old lake or ocean beds, these materials originally had level to gently sloping surfaces, but the soils are highly erodible. As a consequence, about one sixth of the total acreage has been dissected by running water, making the present surface strongly rolling to steep in such areas.

Water does not pass through the silt loam materials readily, and except on the steeper slopes, the soils show the effect of impeded natural drainage. Nearly half of the acreage is so poorly drained that it demands the installation of artificial drainage for efficient production and harvesting of field crops, hay, or pasture. This artificial drainage consists mostly of the removal of surface water, since the subsoils are dense enough that underdrainage is not very efficient. When naturally or artificially well drained, these soils are suited to the production of most of the common crops, especially small grains, grasses, and legumes.

The soils developed on marine and lacustrine materials are divided into six Management Groups (23-28) as follows:

23. Well-drained, deep layer of fine sandy loam over marine silts and clays.
24. Well-drained, very fine sandy loams and silt loams.
25. Moderately well-drained with shallow layer of fine sandy loam over marine silts and clays.
26. Moderately well-drained silt loam.
27. Poorly drained with thin layer of fine sandy loam over marine silts and clays, and poorly drained silts to silty clay loams.
28. Very poorly drained with thin layer of fine sandy loam over marine silts and clays, and very poorly drained silts to silty clay loams.

Soil Management Group 23

Melrose fine sandy loam

The Melrose soil has a layer of well-drained sandy material over deposits of silt and clay. The depth to the silt and clay varies, but it is usually found between three and four feet below the surface of the ground. The deep sandy layer has enough fine material in it to provide good moisture relations for growing crops, and the tillage operations are easily carried out. The presence of the silt and clay below the sandy materials is a major factor in the ability of these soils to withstand drier conditions than the associated sandy soils over more porous material. Natural drainage is good, and since the silt and clay are found at a depth of three to four feet, artificial drainage is not a problem. A wide variety of crops is grown on these soils, among which vegetables occupy a prominent position in the south-

eastern part of the State. The ease of tillage operations, early warming in the spring, and good air and water drainage make these soils highly regarded for intensive cultivation. Along with intensive use goes the added requirement of installation of soil conservation measures to protect the soils from destructive erosion and to maintain them in a perpetually productive condition.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Corn	Orchards†	None
Truck Crops*		
Small Grains		
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alfalfa		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		
Winter Vetch		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Topographic position usually not good for air drainage.

Soil Management Group 24

HARTLAND VERY FINE SANDY LOAM
HARTLAND SILT LOAM
SUFFIELD VERY FINE SANDY LOAM
SUFFIELD SILT LOAM

These soils are well-drained silts and silty clays. They are considered well drained because water and air can move freely through the soil, and water will move out as deep percolation as rapidly as it enters at the surface. Although water movement within the soil is much slower than in the porous sandy soils, this Soil Management Group occurs on sloping land, and less water enters the soil because more of it runs off. These soils have a tendency to form undesirable clods if they are tilled when too wet. Experience in handling this Soil Group is very valuable to the operator from the standpoint of when to work the soil to maintain the structure which is best for plant growth.

Within the limitations of proper soil management, this group of soils is adapted to a variety of crops. Many farmers prefer to use them for the production of hay and pasture in order to reduce the number of times the

soils must be plowed and cultivated. They hold moisture very well and withstand dry periods better than the sandy soils, although during a prolonged drought these soils will bake and crack. The rapid run-off that occurs makes these silty soils highly susceptible to erosion, and protective soil conservation measures are necessary to maintain them in a high state of productivity.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	None
Barley	Truck Crops*	
Oats	Orchards	
Winter Rye	Legumes	
Winter Wheat	Alfalfa	
Grasses	Winter Vetch	
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Soil Management Group 25

ELMWOOD FINE SANDY LOAM

The Elmwood soil has a sandy layer approximately 18 to 24 inches thick overlying silt or clay material. The natural drainage is classified as moderately well drained. This soil is not quite as well drained as those in Group 23, since the silt or clay material is more compact and as a consequence does not permit the downward movement of water as rapidly as does the surface layer above it. As a result, in wet seasons, water will percolate through the sand and accumulate on top of the silt, producing a seasonal perched water table. In a relatively dry season, the moisture relations on these soils are very good for crop growth, but when the season is wet, crop yields are reduced because of the excess of moisture. They are adapted to a fairly wide range of crops in their natural drainage condition, but the yields are subject to the seasonal variations in the amount of rainfall. Artificial drainage possibilities would be worth investigating for specialized crops such as vegetables, where the lengthening of the growing season and the removal of excess moisture during a wet season would be extremely beneficial to crop yields.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Alfalfa
Winter Wheat	Barley	Winter Vetch
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan	Soybeans	
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

II Artifical Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Corn	Legumes	Orchards†
Truck Crops*	Alfalfa	
Small Grains	Winter Vetch	
Barley		
Oats		
Winter Rye		
Winter Wheat		
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Topographic position usually poor for good air drainage.

Soil Management Group 26

Buxton silt loam — Suffield silt loam, mottled subsoil phase

These soils are moderately well-drained silts and silty clays. They occur on gently sloping to nearly level land. As a result, surface water does not run off rapidly. Since water does not move through them very readily, they

are apt to be saturated for a few days during the spring or after heavy rains. Because of the excess water, they do not warm up in the spring as quickly as the soils in Groups 23 and 24, and plowing is delayed. Good yields of forage crops may be obtained in ordinary years; however, difficulty will be experienced in wet years unless artificial drainage is installed. These soils are considered to be well suited to adapted grasses and legumes.

Major Crop Adaptations

I Natural Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards
Oats	Truck Crops*	Legumes
Winter Rye	Small Grains	Winter Vetch
Winter Wheat	Barley	Alfalfa
Grasses	Grasses	
Brome	Orchard	
Millet	Timothy	
Redtop	Legumes	
Reed Canary	Red Clover	
Sudan	Soybeans	
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		

II Artifical Drainage Condition

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Orchards†
Barley	Truck Crops*	
Oats	Legumes	
Winter Rye	Alfalfa	
Winter Wheat	Winter Vetch	
Grasses		
Brome		
Millet		
Orchard		
Redtop		
Reed Canary		
Sudan		
Timothy		
Legumes		
Alsike Clover		
Birdsfoot Trefoil		
Ladino Clover		
Red Clover		
Soybeans		

* Includes potatoes; specific vegetables will have somewhat varying adaptations.
† Air drainage usually poor.

Soil Management Group 27

SCANTIC SILT LOAM SWANTON FINE SANDY LOAM

This group of soils is poorly drained. It includes soils with a layer of sandy material over silts and clays and soils which have developed entirely from silt and clay material. They are found in depressional areas, and the soils are usually saturated to within approximately one foot of the surface during most of the growing season. In their natural drainage condition they are suitable only for inferior hay and pasture production, and farm operations have to be adjusted to the excess moisture conditions that prevail during most of the growing season. Where feasible and economical to install artificial drainage systems, it is possible to improve these areas so that good grass-legume mixtures and an occasional cultivated crop such as corn can be grown.

Artificial drainage is usually confined to "bedding" or the use of open ditches to remove excess surface water quickly. Movement of water through the subsoil is too slow for the use of tile lines or deep ditches to operate effectively unless they are spaced very close together.

Major Crop Adaptations

I NATURAL DRAINAGE CONDITION

Well Adapted	Intermediate	Poorly Adapted
Grasses	Small Grains	Corn
Reed Canary	Winter Rye	Truck Crops*
	Grasses	Orchards
	Brome	Small Grains
	Redtop	Barley
	Legumes	Oats
	Alsike Clover	Winter Wheat
	Birdsfoot Trefoil	Grasses
	Ladino Clover	Millet
		Orchard
		Sudan
		Timothy
		Legumes
		Alfalfa
		Red Clover
		Soybeans
		Winter Vetch

Well Adapted	Intermediate	Poorly Adapted
Small Grains	Corn	Truck Crops*
Winter Rye	Small Grains	Orchards
Grasses	Oats	Small Grains
Brome	Winter Wheat	Barley
Redtop	Grasses	Legumes
Reed Canary	Millet	Alfalfa
Legumes	Orchard	Winter Vetch
Alsike Clover	Sudan	
Birdsfoot Trefoil	Timothy	
Ladino Clover	Legumes	
	Red Clover	
	Soybeans	

* Includes potatoes; specific vegetables will have varying adaptations.

Soil Management Group 28

Biddeford silt loam
Biddeford silty clay loam
Whately fine sandy loam

These soils are very poorly drained and swampy. They include soils with a sandy layer over silts and clays as well as soils that have developed entirely from silt and clay materials. The soils are found in low lying areas and are completely saturated most of the year, with water standing on the surface for many months. These factors limit any agricultural activities to periods of extremely dry weather. The use of these soils is definitely limited by the high water table. Artificial drainage should be installed only where a suitable outlet can be found and the cost involved will be justified by the increased crop yields.

Major Crop Adaptations

Well Adapted	Intermediate	Poorly Adapted
None	Grasses Reed Canary	Corn Truck Crops* Orchards Small Grains Barley Oats Winter Rye Winter Wheat Grasses Brome Millet Orchard Redtop Sudan Timothy Legumes Alfalfa Alsike Clover Birdsfoot Trefoil Ladino Clover Soybeans Winter Vetch

* Includes potatoes; specific vegetables will have somewhat varying adaptations.

Miscellaneous Soils and Land Types

These soils cover a wide range of conditions that cannot be included under the preceding management groups. The soil conditions covered in Management Groups 29, 30, and 31 of this section occupy a large acreage, particularly in the mountainous areas, in the 83 percent of the State covered by glacial till. These Management Groups are not considered to be of much agricultural value from the standpoint of crops; however, most of our woodland area is on these soils. The Management Groups in this section are grouped for convenience into soils and land types of similar origin.

These soils and land types are divided into eight Management Groups (29-36) as follows:

29. Deep, very stony, and rough stony soils with all degrees of drainage.
30. Shallow, very ledgy soils with all degrees of drainage.
31. Rockland, including rock outcrop areas and rough mountain land, deep or shallow, not otherwise specified.
32. Coastal sands, including coastal beach and dunes.
33. Marsh land, including tidal and fresh water marsh.
34. Muck and Peat.
35. Made land, including mineral and organic material.
36. Riverwash.

Roy W. Simonson, Soil Conservation Service

Even very stony soils, like the one in this picture, can be used for pasture.

Soil Management Group 29

BERKSHIRE VERY STONY LOAM
BROOKFIELD VERY STONY LOAM
GLOUCESTER VERY STONY FINE SANDY LOAM
HERMON VERY STONY FINE SANDY LOAM
PERU VERY STONY LOAM
WAUMBEK-PERU-ACTON STONY UNDULATING SOILS
WHITMAN VERY STONY LOAM

ROUGH STONY LAND, DEEP SOIL MATERIAL

A. ACWORTH MATERIAL
B. BECKET MATERIAL
C. BECKET SOIL MATERIAL
D. BERKSHIRE SOIL MATERIAL
E. BROOKFIELD MATERIAL
F. BROOKFIELD SOIL MATERIAL
G. ESSEX SOIL MATERIAL
H. GLOUCESTER MATERIAL
I. GLOUCESTER SOIL MATERIAL
J. HERMON MATERIAL
K. HERMON SOIL METERIAL
L. MARLOW MATERIAL
M. MARLOW SOIL MATERIAL
N. STONY HILLY AND STEEP LAND
O. VERY STONY DEEP SOILS

ROUGH MOUNTAIN LAND, DEEP SOIL MATERIAL

A. BERKSHIRE SOIL MATERIAL
B. HERMON SOIL MATERIAL

DEEP, VERY STONY, AND ROUGH STONY SOILS

These deep, very stony and rough stony soils are quite common in New Hampshire, especially in the more rolling areas. The soils are usually well drained, due to the steepness of the slopes involved, but there are scattered areas with all degrees of impeded natural drainage. The severity of the stony condition usually discourages any attempt to clear the areas for use as cropland, although it is possible to find scattered bodies of these soils adjacent to fields where the cost of clearing may not be too high for the use considered.

Adaptations

The land has value especially for forestry and wildlife management. It is adapted to the growth of trees discussed on page 69 of this bulletin. Steepness and stoniness hinder logging operations. The high proportion of stones throughout the soil probably reduces the rate of tree growth. As a result, the land is not as well suited to commercial forestry as the less stony types.

Soil Management Group 30

Brimfield very stony loam
Canaan very stony fine sandy loam
Hollis very ledgy loam
Hollis very stony loam

Rolling stony land, shallow soil material

A. Brimfield soil material
B. Hollis soil material
C. Rockingham soil material

Rough stony land, shallow soil material

A. Brimfield soil material
B. Canaan soil material
C. Colrain soil material (Strafford county)
D. Hollis soil material
E. Lyman soil material
F. Rockingham soil material
G. Shapleigh soil material
H. Very stony or ledgy, shallow soils

These shallow, very stony, and very ledgy soils are also quite common in New Hampshire, especially in the mountainous terrain. The soils are usually well drained but include smaller scattered areas of all degrees of natural drainage.

Adaptations

This soil group has a more restricted forestry use than the deeper, very stony areas in Group 29 due to the numerous outcroppings of ledge that will be found throughout the indicated areas on soil survey maps. The shallowness of the soil offers a very limited reservoir for tree roots to draw from for water and plant nutrients.

The major value of this type of soil is for forestry and wildlife management and recreational use. Tree species and logging operations would vary somewhat from those recommended under the deep, very stony soils because of the shallower nature of these soils.

Soil Management Group 31

Rockland

A. Brimfield
B. Canaan
C. Lempster
D. Marlow
E. Rock outcrop
F. Shapleigh

These are areas where rock cliffs, bare rock mountain peaks, and nearly bare bedrock occur. Much of this land lies above the timberline in the White Mountains. On the soil survey maps, the areas designated as rock outcrop are at least two or three acres in size. Where bedrock outcrops, but the area of the outcrop is not large enough to show as a separate condition, a small check mark "√" is put on the soil map to indicate the presence of the outcrop. These areas obviously are non-agricultural but have very high recreational and scenic values. Most of the areas support no vegetation, but a few have a growth of a sparse, scrubby nature. They are also of value for some forms of wildlife. It is estimated that at least 50,000 acres in New Hampshire belong to this Soil Management Group.

Soil Management Group 32

Coastal beach — Dune sand

This group of soils includes the coastal beach sands found along the State coastline from Maine to Massachusetts and the areas of sand dunes that are found adjacent to the beaches. They are coarse, very sandy soils and have no particular value for agricultural purposes. The dune sand is constantly shifting about, due to wind action, and is a hazard to adjacent areas that might become covered with deposits of sterile sandy material. For recreation, these soils rank very high.

Soil Management Group 33

Fresh water marsh — Tidal marsh

There are two types of marshland recognized in the soil surveys of the State — tidal marsh and fresh water marsh. Tidal marsh occurs in low areas along the seacoast and is covered with water at high tide. The soils usually have a high content of various salts, and the vegetation consists of sedges, reeds, and grasses, some of which are cut for "salt hay". The areas usually will not support tree growth.

Freshwater marsh occurs around the edges of fresh water ponds and lakes where the water covers them to a depth of a foot or two for all or part of the year. Vegetation consists of grasses, reeds, sedges, and some brush.

Both types of marsh are valuable principally for wildlife and recreation.

Soil Management Group 34

Balch-Littlefield peat
Balch-Littlefield peat, shallow phase
Muck
Muck, shallow phase
Muck and peat
Peat
Peat, shallow phase
Waterboro muck
Waterboro muck, shallow phase

Occupying some marshy areas and former pond sites are deposits of organic matter which have accumulated from the growth and death of many generations of plants. Most of the deposits are more than three feet in depth over mineral soil. Muck and peat areas that are designated as shallow are simply areas that are from twelve inches to three feet in depth. On some areas, the surface layers of muck and peat have developed mostly from woody vegetation, such as trees. Other deposits are mainly from mosses, reeds, and sedges. There may be some mixture with mineral soil material which washed or blew in from surrounding areas during or after the laying-down of the plant remains. The organic material is light in weight, spongy, and porous, and holds several times its own weight in water.

The surface of these deposits is level. They lie in depressions at the level of the ground water table and are difficult to drain. After heavy rains, the water running into the depressions from surrounding uplands may flood the areas for several days. Furthermore, the depressions are frost pockets, and frost may occur every month in the year.

All of the deposits are wet: some of them are saturated all of the year and as a result, decay proceeds very slowly. In this case the surface material is usually brown or light brown and fibrous. The materials are so well preserved that the original plants may be identified. This kind of soil is called peat.

In other cases, the deposit dries out to some extent during part of the year and more decay has occurred. The surface material is dark brown to black, more or less granular, and so completely broken down that it is difficult or impossible to identify the original plants. This soil is called muck.

There are possibly 100,000 acres or more of this kind of land scattered over the State in tracts too small to show on the Generalized Soil Association Map (Figure 8). Mucks and peats are found in all parts of the State and as a result, the organic deposits may be underlain by sands, silts, glacial till, or even rock. Partial soil surveys show that four fifths of the muck and peat soils support trees, such as alder, willow, red maple, northern white cedar, tamarack, black spruce, and balsam-fir.

Much of the remainder is too wet to support tree growth and is covered with sedges, reeds, grass, sphagnum moss, and other mosses and shrubs. Only one percent is cropped, almost entirely to hay, and about the same amount is pastured.

Crop Adaptations

The uses of these areas are very limited for agricultural purposes, due to the soil conditions and the fact that they are generally frost pockets. Some of the muck areas are used for wild hay, but the economic value of such a crop, coupled with the difficulties of harvesting it, make it a very questionable practice. There are large bodies of muck in other sections of the country, where the growing season and other conditions are more favorable, that are utilized for intensive cultivation after artificial drainage is installed.

The areas in New Hampshire are usually small, inaccessible in many cases, and subject to definite frost hazards. The problem of artificial drainage is very complex due to the type of material and the scarcity of suitable outlets. Many of these areas have trees growing on them at the present time, and this use should be encouraged where it exists. Another major use for many of these areas is to encourage measures that are beneficial for wildlife. These wildlife measures are relatively easy to carry out, and they provide a productive use for areas that otherwise would probably be of very little use for agriculture.

Some of the woody mucks of New Hampshire, formed from hardwood tree residues, are quite productive. If the cost of artificial drainage is not excessive, they make good hay and pasture land. Usually, however, the high cost of drainage would require that they be used for the production of high value crops such as vegetables. Muck farming requires a very specialized type of management, and there are hazards as well as opportunities in this enterprise.

When drained, the surface of muck and peat soils shrinks about one third of its volume during the first two or three years. After that, the soil may subside an inch or more a year because the artificial drainage stimulates more rapid decay. Drained muck is subject to wind erosion which not

only removes the soil itself but may also cut off the leaves or expose the roots of any crop that is being grown. Another hazard is fire, which may destroy the material down to the water table. Most of the mucks and peats in New Hampshire are strongly acid and would require heavy applications of lime if farmed intensively for vegetables. If managed wisely, however, some areas of muck may be successfully farmed.

Some tracts of peat may have possibilities of being excavated and sold commercially as peat moss. So far as is known to the authors, no deposits at present are developed for this purpose, but there is no reason why such a venture could not be successful. The quality of the peat, the costs of operation, and the market possibilities should be explored thoroughly before entering into this type of business.

Soil Management Group 35

Made land — Made land (Organic)

These areas have been cut down or filled with varying types of mineral soil material. Usually areas of this group are found in and adjacent to cities, towns, and recreational areas. They have no definite soil profile. An unusual made land condition exists in many small areas adjacent to large paper mills in the northern part of New Hampshire. The fill material is bark derived from peeling the pulpwood in the paper milling process.

Soil Management Group 36

Riverwash

Riverwash is the coarse material deposited along the streams in the form of sand, gravel, and cobbles. This condition arises as the shifting of the stream channel exposes old deposits or lays down new ones. Riverwash is a temporary condition and is subject to being frequently shifted by swift currents. It is considered non-agricultural land and is usually bare of vegetation; however, some places support a sparse growth of shrubs, small trees, and weeds. If undisturbed over a long period of time, this group of soils will support a more luxuriant growth of trees and grasses.

V. Soils and Forests

Forests and their Use

FORESTRY is very important in New Hampshire, both from the standpoint of the percentage of land occupied and the volume of business it represents.

Table 4 shows that 83.9 percent of New Hampshire is covered by woodlands. The variation in percentage of woodlands by counties ranges from 74.3 percent in Rockingham to 89.4 percent in Coos County.

The stumpage value of the annual timber harvest in New Hampshire is estimated at $5,000,000. The 1949 income of persons employed in wood-using industries was estimated at $45,000,000. To obtain the complete picture of the value of New Hampshire forests, we must add $5,000,000 for the income of self-employed persons and $45,000,000 more for income to the trades which service forest industries. The estimated total yearly income generated by New Hampshire's forests is therefore $100,000,000 or one sixth of the total income of the State.

Table 4. Woodlands in New Hampshire*
(1948)

County	Woodland Area		Total Woodlands (acres)	Total Land Area (acres)	Area in Woodlands (percent)
	Commercial (acres)	Non-commercial (acres)			
Belknap	205,400	1,500	207,900	256,600	81.0
Carroll	525,400	9,100	534,500	600,300	89.0
Cheshire	389,700	3,600	393,300	458,900	85.7
Coos	984,200	60,500	1,044,700	1,168,000	89.4
Grafton	866,400	77,000	943,400	1,098,900	85.8
Hillsborough	442,300	9,300	451,600	569,600	79.3
Merrimack	480,200	3,000	483,200	595,900	81.1
Rockingham	327,200	1,200	328,400	442,200	74.3
Strafford	179,400	400	179,800	241,300	74.5
Sullivan	281,000	—	281,000	343,700	81.8
Total	4,682,200	165,600	4,847,800	5,775,400	83.9

*The Forest Resources of New Hampshire, Forest Resource Report No. 8, Forest Service, U. S. Department of Agriculture, 1954.

Forests have more than a dollar value. Forests are protective as well as productive. They protect the soil against erosion and encourage rainwater and snow to seep into the soil, later to emerge as beneficial springs. Damaging floods are thus reduced.

Forests serve best as a protective cover only when the forest floor has a deep layer of spongy and absorbent leaves and humus. This organic layer guides rain and melted snow harmlessly into deeper layers of the soil. Even when frozen, the porous organic layer is "honeycombed" and will permit water to move fairly rapidly through it into deeper unfrozen soil. In this way, spring flood crests are reduced.

But it is not without effort that a forest will protect soil and water most effectively. Forests must be harvested wisely, fires kept out, and the packing action of the feet of grazing cattle must be kept to a minimum.

Forest Types and Soil Management Groups

MOST TREES have a wide adaptation and are found on many kinds of soil. The pines do better than the hardwoods on the droughty sands, and the spruce-fir type does well on the low swampy areas. Locally, the distribution of forest types is the result of past management and of soil conditions. There is a relation between soil condition and growth rates, with the best growth on the moist soils with the most uniform supply of water. The principal acreage of such soils is found in Soil Management Groups 1, 3, 6, and 7, and their stony counterparts in Group 10.

The map (Figure 10) shows the forest cover type groups for New Hampshire and Table 5 gives the acreages of each type.

Table 5. The Forest Types of New Hampshire and Their Acreages*

Forest Types	Commercial Forest Land	
	Acres	Percent of Total
Hardwood Group (maple, beech, birch)		
Yellow birch — sugar maple — beech	1,230,900	26
Hardwood — spruce — fir	494,100	11
Hardwood — white pine	444,500	9
Oak	94,700	2
Aspen — maple — elm	90,000	2
Total	2,354,200	50
White Pine Group (white, red, jack pine)		
White pine	760,000	16
White pine — hardwood	331,600	7
Hemlock	223,300	5
Pitch pine	24,500	1
Total	1,339,400	29
Spruce — Fir Group		
Spruce — fir	366,300	8
Spruce — fir — hardwood	207,100	4
Cedar — tamarack — spruce	33,900	1
Total	607,300	13
Aspen — Paper Birch Group (aspen, birch)		
Aspen — grey birch	249,200	5
Paper birch	132,100	3
Total	381,300	8
Total for State	4,682,200	100

*The Forest Resources of New Hampshire, Forest Service Report No. 8, Forest Service, U. S. Department of Agriculture, 1954.

Soil Conservation Service

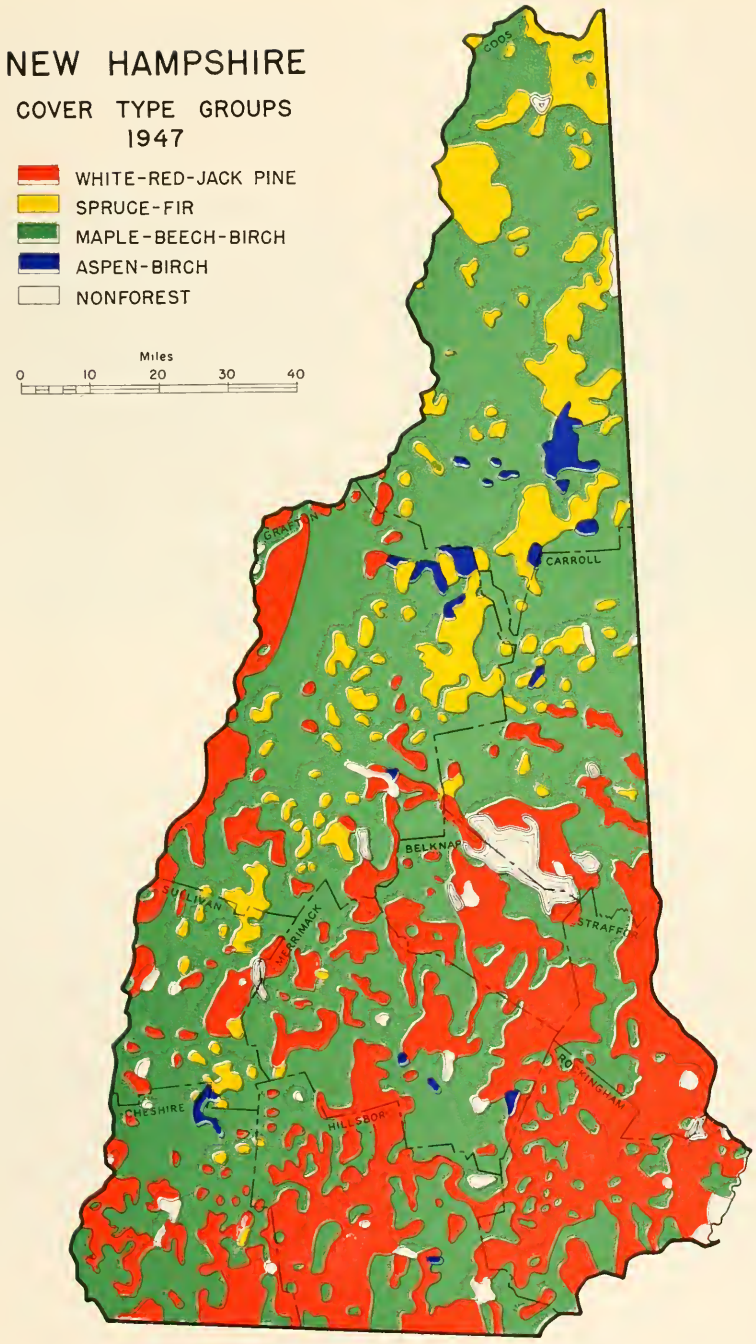
Hardwood types of trees make up half of the State's commercial forest land.

Of all Forest Type Groups, the Hardwood Group occupies the most area, namely, 50 percent of the commercial forest land. Next in area is the White Pine Group with 29 percent, the Spruce-Fir Group with 13 percent, and the remaining 8 percent is occupied by the Aspen-Paper Birch Group.

The Hardwood Group (shown in Figure 10 as Maple-Beech-Birch) is distributed over the State mostly on well-drained loams and sandy loams of moderate to high productivity. (Soil Management Groups 1-5, 10, 29, and 30.)

Soil Conservation Service

The pine types occur mostly in glacial outwash in southern New Hampshire.



U. S. Department of Agriculture

Figure 10.

The White Pine Group (shown on the map as White-Red-Jack Pine) lies mostly in the southern two thirds of the State on well to excessively drained sandy soils. (Soil Management Groups 2, 5, 10, 12, 13, and 14.)

The Spruce-Fir Group is found at the higher elevations on shallow and stony upland soils and also in the very poorly drained (swampy) areas. These forest types occur mostly on Soil Management Groups 1, 6, and 8-11.

Soil Conservation Service

U. S. Forest Service

Spruce-fir types (left) occur on stony uplands in northern New Hampshire. The aspen-birch types (right) furnish protection after fires or clear-cutting.

The Aspen-Birch Group consists of a temporary vegetation usually following fires or clear-cutting. The soils on which these temporary forest types occur are mostly stony, well-drained and moderately well-drained soils, shown as Soil Management Groups 10, 29, and 30.

VI. Soils and Types of Farming[1]

Types of Farming

TYPES OF farming refers to the principal kinds of products grown on most of the farms in a specific area. The types of farming are determined by physical, economic, biological, and historical influences. Among the physical influences are soils, topography, and climate. The economic influences include the prices for various products and the cost of things necessary in their production. The biological influences include insects, diseases, and predators of livestock. History enters the type of farming pattern through the influences of the past on the farmer's skills, likes, dislikes, and prejudices; and the types of buildings and other resources already available on the farm.

The principle that encompasses all of these influences is that people tend to use their resources for the purposes that give them the greatest satisfaction and the highest money return. For a type of farming, such as dairying, to prevail in an area, the combination of physical, economic, and social factors must be sufficiently favorable to provide a satisfactory income to dairy farmers which they believe to be greater than they could earn in some other enterprise.

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[1] This section originally was written by W. K. Burkett, Associate Agricultural Economist, New Hampshire Agricultural Experiment Station, 1955.

Soil Conservation Service

Dairy farming prevails where soil, economic, and social factors are favorable.

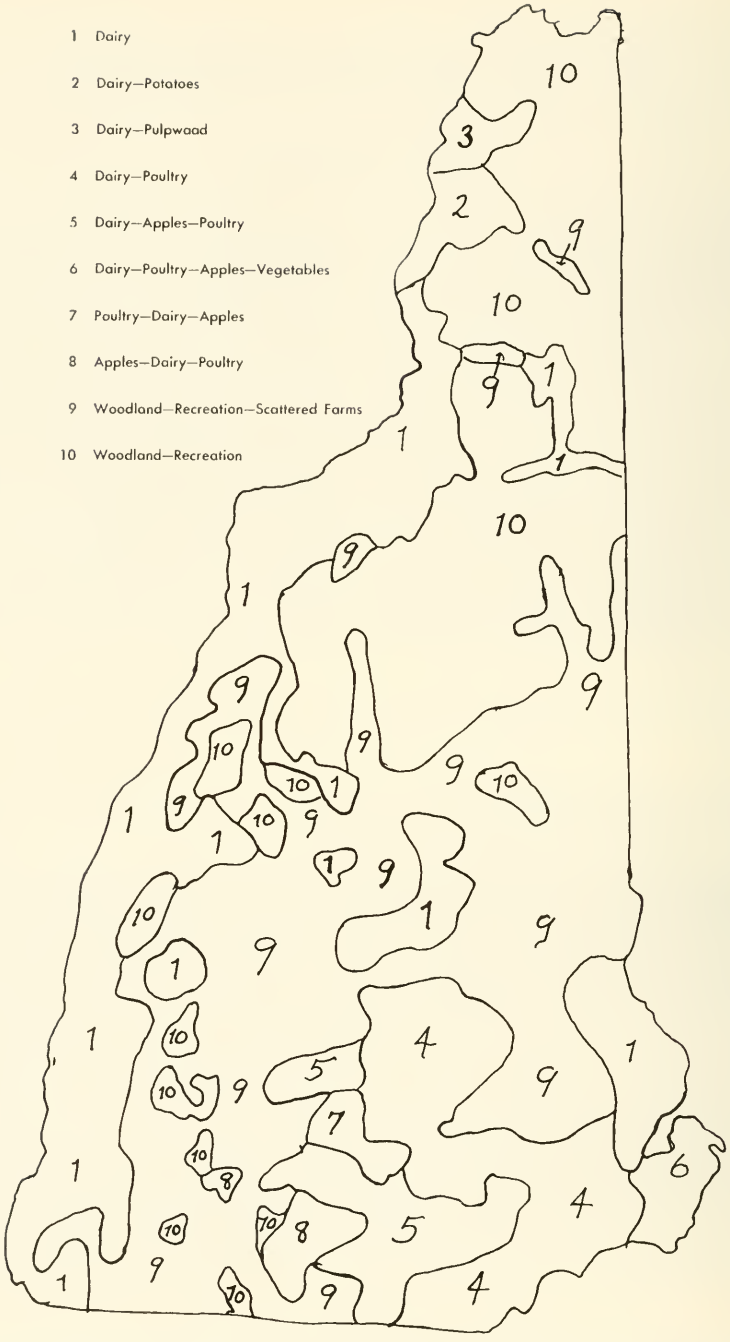

Figure 11. Type-of-Farming Areas in New Hampshire, adapted by W. K. Burkett from Agricultural Experiment Station Circular 53, by H. C. Grinnell, 1935.

Broadly speaking, the farming types of New Hampshire, like those of most of New England, are ones which are influenced by large population centers.[1]

The accompanying map (Figure 11) is adapted from New Hampshire Circular 53.[2] Although the original study was made in 1935, the broad picture of what is produced and where it is produced is still fairly accurate. The type-of-farming map was made by locating each farm on a township map and showing the size and kind of farming carried on there. The changes on this map are based on the information contained in the Census and by personal observations as to where the changes have taken place.

Some general changes since 1935 may be mentioned for readers who want to refer to the original type-of-farming map. 1. Poultry farms are relatively more numerous and widely scattered in the southern part of the State than they were in 1935. Broiler as well as egg production is now more important. 2. Fruit and potatoes are relatively less important than in 1935, although still ranking high as sources of dollar income. 3. Retail milk farms are considerably less numerous than they were 20 years ago. 4. There are fewer farms in the areas where the soils are less fertile, and the present farms in all parts of the State are now larger.

There are two principal areas in the State where there is a considerable amount of farming. One is along the western border of New Hampshire and is made possible by the level, stone-free soils of the Connecticut River Valley, its tributary valleys, and the adjoining benches and slopes. In this Connecticut River belt, the farms are more nearly continuous than in other parts of the State. Specialized dairy farming is the prevailing type of farming, although in places there are considerable numbers of poultry and miscellaneous types of farms. Physical conditions are relatively favorable to hay and pasture production, and the Greater Boston area provides a market for fluid milk. Potatoes and pulpwood add to income on some dairy farms in the northern part of the area, and a few farmers specialize in producing potatoes.

The other large area with considerable farming is in the southeast one fourth of the State. This includes the fairly level coastal areas of the extreme southeast and the valleys of the Merrimack River and its tributaries. In a few places the commercial farms are nearly continuous, but for the most part they are scattered. The scattering of the farms is due to two influences. One is the varying character of the soil; the other is the presence of rural residences, part-time farms, and other forms of land use that always compete with farming near large centers of population.[3]

Fruit and vegetable production is of importance in an area south of the city of Portsmouth and in a larger area comprising eastern Hillsborough, southern Merrimack, and western Rockingham counties. A combination of soil, climate, and markets is favorable for fruit and vegetable production and consumption. Many of the fruits and vegetables are sold within short

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[1] There are several studies which picture and explain the type of farming of New Hampshire. Of most direct interest are: *Type-of-Farming Areas in New Hampshire,* New Hampshire Circular 53, by H. C. Grinnell, and *Dairy Opportunity Areas in New Hampshire,* New Hampshire Station Bulletin 340, by H. C. Woodworth and J. C. Holmes.

[2] *Type-of-Farming Areas in New Hampshire, ibid.*

[3] *New Hampshire's Idle Farm Land,* W. K. Burkett, New Hampshire Agricultural Experiment Station, Bulletin 399, 1953.

trucking distance for use in such centers as Dover, Portsmouth, Concord, Manchester, and Nashua, and the urban belt just across the Massachusetts line. Some fruits and vegetables go into the still larger market of Boston.

The part of the State shown as Woodland-Recreation-Scattered Farms is used predominantly for forestry, recreation, and in some places, as residential areas. The soil is mostly too hilly, sandy, and stony for use as field crops or improved pastures.

The area on the map shown as Woodland-Recreation is mainly mountainous and stony and includes the well-known White Mountain National Forest and the famous Presidential Mountain Range. Fishing, scenic drives, mountain climbing, and skiing attract many tourists and sportsmen.

Types of Farming and Soils

SINCE SOIL conditions form only one of several factors that influence the types of farming, we would expect no exact relationship between the two. It will be noted, however, that there is some similarity between the type-of-farming map (Figure 11) and the Soil Association map (Figure 8). It should be remembered, furthermore, that within any of the type-of-farming areas, the choice of crop varieties on any individual farm will be governed to quite an extent by the soil conditions.

The type-of-farming map shows the location of 10 farming types in New Hampshire, as follows: 1. Dairy, 2. Dairy—Potatoes, 3. Dairy—Pulpwood, 4. Dairy—Poultry, 5. Dairy—Apples—Poultry, 6. Dairy—Poultry—Apples—Vegetables, 7. Poultry—Dairy—Apples, 8. Apples—Dairy—Poultry, 9. Woodland—Recreation—Scattered Farms, 10. Woodland—Recreation.

Each of the 10 type-of-farming areas will be discussed in relation to the Soil Management Groups occurring in each area which are best adapted. The stony counterpart of the glacial till soils occur in close association with the non-stony soils and are not listed specifically unless they are very significant.

Dairy

The Dairy Area is concentrated along the alluvial soils of the Connecticut River and in other scattered areas over the State. The best dairy farms are located on loamy soils which are well drained, moisture retentive, and at least originally were moderately productive. These soils are shown as Soil Management Groups 1, 3, 14, and 19.

Dairy production and forage production are so closely related that it is not possible to be successful in the dairy business unless the pasture and hay lands are well adapted to the production of high quality forage.

Dairy — Potatoes

The Dairy—Potato Area is located in northwestern Coos County on slopes adjoining the Connecticut River, in the vicinity of Colebrook. A combination of loamy, productive soils, gently rolling hills, and only a moderate number of stones to hinder cultivation make this area well adapted for both dairy farming and potato production. The soils are shown mostly in Soil Management Group 1.

Dairy — Pulpwood

The Dairy—Pulpwood type-of-farming lies immediately to the north of the Dairy—Potatoes area in Coos County. A combination of gentle slopes and moderately productive loam and stony loam soils make this kind of farming possible. The area is shown in Soil Management Group 1, 10, and 29.

Dairy — Poultry

In southeastern New Hampshire on the gently rolling loam and fine sandy loam soils of Groups 2 and 14 is an area devoted mainly to dairy farming and poultry production.

Dairy — Apples — Poultry

In south central New Hampshire are two areas known as the Dairy—Apples—Poultry Area. The soils are moist sandy loam and loam soils which are included in Soil Management Groups 1 and 3.

Dairy — Poultry — Apples — Vegetables

Extending inland for several miles from New Hampshire's seacoast lies an intensively utilized area of land known as the Dairy—Poultry—Apples—Vegetables Area. It is mostly Soil Management Groups 1, 3, 14, and 23.

Poultry — Dairy — Apples

In the central part of southern New Hampshire where the soils are mostly sandy loams lies the Poultry—Dairy—Apples Area. It is shown in Soil Management Groups 2 and 4.

Apples — Dairy — Poultry

Two rather small areas of sandy loam soils in the southern part of the State are classified as the Apples—Dairy—Poultry Area, shown as Soil Management Group 2.

Woodland — Recreation — Scattered Farms

The Woodland—Recreation—Scattered Farms Area occupies the large and continuous hilly, stony, sandy soils in the central eastern and west central parts of New Hampshire. The soils that predominate are shown in Soil Management Groups 2 and 10.

Woodland — Recreation

The Woodland—Recreation Area is located in central and northern New Hampshire on steep and mountainous, stony, sandy loam soils which are not naturally fertile. These are shown as Soil Management Groups 29, 30, and 31.

Soil Conservation Service

The Woodland-Recreation area, typified by this ski area at Gilford, is located in central and northern New Hampshire on mountainous and stony soils.

Types of Farms by Regions

TABLE 6, compiled from the 1955 Census of Agriculture, shows the number of farms of each type by counties in the three regions in the State. These regions are: the Connecticut Valley Area, comprising Coos, Grafton, Sullivan, and Cheshire Counties; the Southeast Area, including Merrimack, Hillsborough, Rockingham, and Strafford Counties; and the East Central Area, with Belknap and Carroll Counties.

In all of the State's 10,413 farms, nearly 43 percent are classified as miscellaneous. Next in order are farms classified as dairy, poultry, general, livestock, fruit, vegetable, and field crop.

Excluding miscellaneous farms, dairy farming predominates in the Connecticut Valley Area. However, in three of the four counties in the Southeast Area, poultry farms outnumber other types of farms. In the East Central Area, one county contains more dairy farms than poultry farms and in the other county the converse is true.

Table 6. Types of Farming by Regions*

Type of Farm (1954)	Connecticut Valley Area				Southeast Area				East Central Area		
	Coos County	Grafton County	Sullivan County	Cheshire County	Merrimack County	Hillsboro County	Rockingham County	Strafford County	Belknap County	Carroll County	Total for Counties
Dairy	381	459	288	245	270	259	377	180	136	72	2667
Poultry	10	135	75	130	386	340	466	135	100	120	1897
Livestock (a)	50	61	51	30	95	10	55	40	41	35	468
Fruit and nut (b)	.....	10	.....	.....	30	50	15	5	20	.....	130
Vegetable	10	5	5	10	15	5	40	5	10	10	115
Field crop (c)	36	5	.....	.....	10	.....	11	.....	10	.....	72
General (d)	36	116	95	26	88	15	105	80	20	21	602
Miscellaneous and unclassified (e)	146	573	301	346	713	1134	600	197	221	231	4462
Total for counties	669	1364	815	787	1607	1813	1669	642	558	489	
Total for areas	3635				5731				1047		10413

*1955 Census of Agriculture.

(a) Livestock other than dairy and poultry.

(b) Small fruits and tree fruits. Probably no nut farms.

(c) Field crop farms other than vegetable and fruit-and-nut. Includes potatoes and miscellaneous crops.

(d) *General* because no one source or one group of sources amounts to 50 percent of value of farm products sold. Most are primarily crop farms and may include vegetables, fruits, grains, and other field crops.

(e) Includes part-time, residential, unusual and miscellaneous types of commercial farms.

Appendix A

Soil Types Mapped in New Hampshire and their Soil Management Group Numbers

Acton loam — 6
Acton stony loam — 10

Acworth loam — 2
Acworth stony loam — 10

Adams loamy sand — 12
Adams loamy fine sand — 12
Adams fine sandy loam — 14

Agawam loamy fine sand — 12
Agawam fine sandy loam — 14
Agawam very fine sandy loam — 14

Alluvial soils, undifferentiated — 22

Balch-Littlefield peat — 34
Balch-Littlefield peat, shallow phase — 34

Barnstead loamy sand — 12
Barnstead sandy loam — 13
Barnstead fine sandy loam — 14

Becket loam — 3
Becket stony loam — 10

Berkshire loam — 1
Berkshire stony loam — 10
Berkshire very stony loam — 29

Biddeford silt loam — 28
Biddeford silty clay loam — 28

Blandford loam — 3

Brimfield loam — 4
Brimfield ledgy loam — 5
Brimfield stony loam — 5
Brimfield very stony loam — 30
Brimfield, rockland — 31

Brookfield fine sandy loam — 2
Brookfield loam — 2
Brookfield stony fine sandy loam — 10
Brookfield stony loam — 10
Brookfield stony loam, shallow phase — 5
Brookfield very stony loam — 29

Buxton silt loam — 26

Canaan sandy loam — 4
Canaan fine sandy loam — 4
Canaan loam — 4
Canaan ledgy fine sandy loam — 5
Canaan stony fine sandy loam — 5
Canaan stony loam — 5
Canaan very stony fine sandy loam — 30
Canaan, rockland — 31

Charlton loam — 1
Charlton stony loam — 10

Coastal Beach — 32

Colebrook loamy fine sand — 12
Colebrook gravelly fine sandy loam — 14
Colebrook fine sandy loam — 14

Colrain loam — 1
Colrain stony loam — 10
Colrain loam (Strafford County) — 4
Colrain stony loam (Strafford County) — 5

Colton loamy sand — 12
Colton loamy fine sand — 12
Colton gravelly sandy loam — 13
Colton sandy loam — 13
Colton gravelly fine sandy loam — 14
Colton fine sandy loam — 14
Colton stony gravelly fine sandy loam — 10

Danby gravelly loamy sand — 12
Danby loamy sand — 12
Danby loamy fine sand — 12
Danby stony loamy fine sand — 10
Danby gravelly sandy loam — 13
Danby gravelly fine sandy loam — 13
Danby fine sandy loam — 13
Danby stony gravelly fine sandy loam — 10

Dixville loamy fine sand — 12
Dixville gravelly fine sandy loam — 13
Dixville fine sandy loam — 13

Duane fine sandy loam — 15

Dune Sand — 32

Elmwood fine sandy loam — 25

Essex loam — 3
Essex stony loam — 10

Fresh Water Marsh — 33

Gloucester sandy loam — 2
Gloucester fine sandy loam — 2
Gloucester loam — 2
Gloucester stony sandy loam — 10
Gloucester stony fine sandy loam — 10
Gloucester stony loam — 10
Gloucester very stony fine sandy loam — 29

Grafton loam — 2
Grafton stony loam — 10

Greensboro fine sandy loam — 1
Greensboro loam — 1
Greensboro stony loam — 10

Groveton loamy fine sand — 12
Groveton fine sandy loam — 14
Groveton very fine sandy loam — 14

Hadley loamy fine sand, low bottom phase —18
Hadley very fine sandy loam — 19
Hadley very fine sandy loam, low bottom phase — 19
Hadley very fine sandy loam, high bottom phase — 19

Hadley silt loam — 19
Hartland very fine sandy loam — 24
Hartland silt loam — 24

Hermon sandy loam — 2
Hermon fine sandy loam — 2
Hermon stony sandy loam — 10
Hermon stony fine sandy loam — 10
Hermon stony loam, hardpan phase — 10
Hermon very stony fine sandy loam — 29

Hinckley gravelly loamy sand — 12
Hinckley loamy sand — 12
Hinckley loamy fine sand — 12
Hinckley gravelly sandy loam — 13
Hinckley gravelly fine sandy loam — 13
Hinckley fine sandy loam — 13
Hinckley stony gravelly fine sandy loam — 10

Hollis loam — 4
Hollis ledgy loam — 5
Hollis stony loam — 5
Hollis very ledgy loam — 30
Hollis very stony loam — 30

Jaffrey loamy sand — 12
Jaffrey gravelly sandy loam — 13

Leicester loam — 8

Lempster stony loam — 5
Lempster, rockland — 31

Limerick silt loam — 21

Lyman loam — 4
Lyman ledgy loam — 5
Lyman stony loam — 5

Made Land — 35
Made Land, Organic — 35

Marlow loam — 3
Marlow stony loam — 10
Marlow, rockland — 31

Melrose loamy sand — 12
Melrose fine sandy loam — 23

Merrimac gravelly loamy sand — 12
Merrimac loamy sand — 12
Merrimac stony loamy sand — 10
Merrimac loamy fine sand — 12
Merrimac gravelly sandy loam — 13
Merrimac sandy loam — 13
Merrimac gravelly fine sandy loam — 14
Merrimac fine sandy loam — 14

Muck — 34
Muck, shallow phase — 34
Muck and peat — 34

Nashua loamy sand — 12
Nashua loamy fine sand — 12
Nashua fine sandy loam — 14
Nashua very fine sandy loam — 14
Nashua loam — 14

Newmarket loam — 2
Newmarket stony loam — 10

Newport loam — 1

Ninigret very fine sandy loam — 15

Ondawa loamy sand — 18
Ondawa loamy fine sand — 18
Ondawa loamy fine sand, high bottom phase — 18
Ondawa sandy loam — 19
Ondawa fine sandy loam — 19
Ondawa fine sandy loam, high bottom phase — 19
Ondawa very fine sandy loam — 19
Ondawa very fine sandy loam, high bottom phase — 19
Ondawa silt loam — 19
Ondawa silt loam, high bottom phase — 19

Paxton loam — 3
Paxton loam, deep phase — 3
Paxton stony loam — 10
Paxton stony loam, deep phase — 10

Peat — 34
Peat, shallow phase — 34

Peru loam — 6
Peru stony loam — 10
Peru very stony loam — 29

Peterboro gravelly fine sandy loam — 11

Podunk loamy fine sand — 20
Podunk fine sandy loam — 20
Podunk very fine sandy loam — 20
Podunk silt loam — 20

Podunk-Rumney fine sandy loam — 21
Podunk-Rumney silt loam — 21

Ridgebury loam — 8

Riverwash — 36

Rockingham loam — 4
Rockingham ledgy loam — 5
Rockingham stony loam — 5

Rockland — 31
- a. Brimfield
- b. Canaan
- c. Lempster
- d. Marlow
- e. Rock Outcrop
- f. Shapleigh

Rolling stony land, shallow soil material — 30
- a. Brimfield soil material
- b. Hollis soil material
- c. Rockingham soil material

Rough mountain land, deep soil material — 29
- a. Berkshire soil material
- b. Hermon soil material

Rough stony land, deep soil material — 29
- a. Acworth material
- b. Becket material
- c. Becket soil material
- d. Berkshire soil material
- e. Brookfield material
- f. Brookfield soil material
- g. Essex soil material
- h. Gloucester material
- i. Gloucester soil material
- j. Hermon material
- k. Hermon soil material
- l. Marlow material

m. Marlow soil material
n. Stony hilly and steep land
o. Very stony deep soils

Rough stony land, shallow soil material — 30
a. Brimfield soil material
b. Canaan soil material
c. Colrain soil material (Strafford County)
d. Hollis soil material
e. Lyman soil material
f. Rockingham soil material
g. Shapleigh soil material
h. Very stony or ledgy, shallow soils

Rumney fine sandy loam — 21
Rumney silt loam — 21
Rumney-Saco soil — 22

Saco fine sandy loam — 22
Saco silt loam — 22

Saugatuck fine sandy loam — 16

Scantic silt loam — 27

Scarboro fine sandy loam — 17
Scarboro loam — 17
Scarboro silt loam — 17

Scituate loam — 7
Scituate stony loam — 10

Shapleigh sandy loam — 4
Shapleigh fine sandy loam — 4
Shapleigh loam — 4
Shapleigh stony sandy loam — 5
Shapleigh stony fine sandy loam — 5
Shapleigh ledgy loam — 5
Shapleigh, rockland — 31

Skerry loam — 7
Skerry stony loam — 10

Sudbury loamy sand — 15
Sudbury fine sandy loam — 15
Sudbury very fine sandy loam — 15
Sudbury loam — 15
Sudbury silt loam — 15

Suffield very fine sandy loam — 24
Suffield silt loam — 24
Suffield silt loam, mottled subsoil phase — 26
Suffield stony silt loam — 10

Sutton silt loam — 6
Sutton loam — 6
Sutton stony loam — 10

Swanton fine sandy loam — 27

Tidal Marsh — 33

Walpole fine sandy loam — 16

Warwick gravelly loam — 14

Waterboro muck — 34
Waterboro muck, shallow phase — 34

Waumbek loam — 6
Waumbek stony fine sandy loam — 10
Waumbek stony loam — 10
Waumbek-Peru-Acton loam — 6
Waumbek-Peru-Acton stony loam — 10
Waumbek-Peru-Acton stony undulating soil — 29

Westminster loam — 4
Westminster ledgy loam — 5

Whately fine sandy loam — 28

Whitman loam — 9
Whitman stony loam — 11
Whitman very stony loam — 29

Windsor sand — 12
Windsor fine sand — 12
Windsor loamy fine sand — 12

Winooski fine sandy loam — 20

Woodbridge loam — 7
Woodbridge silt loam — 7
Woodbridge stony loam — 10
Woodbridge stony silt loam — 10

Appendix B

Soil Management Groups and their Soil Types

Soil Management Group 1

Berkshire loam
Charlton loam
Colrain loam
Greensboro fine sandy loam
Greensboro loam
Newport loam

Soil Management Group 2

Acworth loam
Brookfield fine sandy loam
Brookfield loam
Gloucester sandy loam
Gloucester fine sandy loam
Gloucester loam
Grafton loam
Hermon sandy loam
Hermon fine sandy loam
Newmarket loam

Soil Management Group 3

Becket loam
Blandford loam
Essex loam
Marlow loam
Paxton loam
Paxton loam, deep phase

Soil Management Group 4

Brimfield loam
Canaan sandy loam
Canaan fine sandy loam
Canaan loam
Colrain loam (Strafford County)
Hollis loam
Lyman loam
Rockingham loam
Shapleigh sandy loam
Shapleigh fine sandy loam
Shapleigh loam
Westminster loam

Soil Management Group 5

Brimfield ledgy loam
Brimfield stony loam
Brookfield stony loam, shallow phase
Canaan ledgy fine sandy loam
Canaan stony fine sandy loam
Canaan stony loam
Colrain stony loam (Strafford County)
Hollis ledgy loam
Hollis stony loam
Lempster stony loam
Lyman ledgy loam
Lyman stony loam
Rockingham ledgy loam
Rockingham stony loam
Shapleigh stony sandy loam
Shapleigh stony fine sandy loam
Shapleigh ledgy loam
Westminster ledgy loam

Soil Management Group 6

Acton loam
Peru loam
Sutton loam
Sutton silt loam
Waumbek loam
Waumbek-Peru-Acton loam

Soil Management Group 7

Scituate loam
Skerry loam
Woodbridge loam
Woodbridge silt loam

Soil Management Group 8

Leicester loam
Ridgebury loam

Soil Management Group 9

Whitman loam

Soil Management Group 10

Acton stony loam
Acworth stony loam
Becket stony loam
Berkshire stony loam
Brookfield stony fine sandy loam
Brookfield stony loam
Charlton stony loam
Colrain stony loam
Colton stony gravelly fine sandy loam
Danby stony loamy fine sand
Danby stony gravelly fine sandy loam
Essex stony loam
Gloucester stony sandy loam
Gloucester stony fine sandy loam
Gloucester stony loam
Grafton stony loam
Greensboro stony loam
Hermon stony sandy loam
Hermon stony fine sandy loam
Hermon stony loam, hardpan phase
Hinckley stony gravelly fine sandy loam
Marlow stony loam
Merrimac stony loamy sand
Newmarket stony loam
Paxton stony loam
Paxton stony loam, deep phase
Peru stony loam
Scituate stony loam
Skerry stony loam
Suffield stony silt loam
Sutton stony loam
Waumbek stony fine sandy loam
Waumbek stony loam
Waumbek-Peru-Acton stony loam
Woodbridge stony loam
Woodbridge stony silt loam

Soil Management Group 11

Whitman stony loam

Soil Management Group 12

Adams loamy sand
Adams loamy fine sand
Agawam loamy fine sand
Barnstead loamy sand
Colebrook loamy fine sand
Colton loamy sand
Colton loamy fine sand
Danby gravelly loamy sand
Danby loamy sand
Danby loamy fine sand
Dixville loamy fine sand
Groveton loamy fine sand
Hinckley gravelly loamy sand
Hinckley loamy sand
Hinckley loamy fine sand
Jaffrey loamy sand
Melrose loamy sand
Merrimac gravelly loamy sand
Merrimac loamy sand
Merrimac loamy fine sand
Nashua loamy sand
Nashua loamy fine sand
Windsor sand
Windsor fine sand
Windsor loamy fine sand

Soil Management Group 13

Barnstead sandy loam
Colton gravelly sandy loam
Colton sandy loam
Danby gravelly sandy loam
Danby gravelly fine sandy loam
Danby fine sandy loam
Dixville gravelly fine sandy loam
Dixville fine sandy loam
Hinckley gravelly sandy loam
Hinckley gravelly fine sandy loam
Hinckley fine sandy loam
Jaffrey gravelly sandy loam
Merrimac gravelly sandy loam
Merrimac sandy loam

Soil Management Group 14

Adams fine sandy loam
Agawam fine sandy loam
Agawam very fine sandy loam
Barnstead fine sandy loam
Colebrook gravelly fine sandy loam
Colebrook fine sandy loam
Colton gravelly fine sandy loam
Colton fine sandy loam
Groveton fine sandy loam
Groveton very fine sandy loam
Merrimac gravelly fine sandy loam
Merrimac fine sandy loam
Nashua fine sandy loam
Nashua very fine sandy loam
Nashua loam
Peterboro gravelly fine sandy loam
Warwick gravelly loam

Soil Management Group 15

Duane fine sandy loam
Ninigret very fine sandy loam
Sudbury loamy sand
Sudbury fine sandy loam
Sudbury very fine sandy loam
Sudbury loam
Sudbury silt loam

Soil Management Group 16

Saugatuck fine sandy loam
Walpole fine sandy loam

Soil Management Group 17

Scarboro fine sandy loam
Scarboro loam
Scarboro silt loam

Soil Management Group 18

Hadley loamy fine sand, low bottom phase
Ondawa loamy sand
Ondawa loamy fine sand
Ondawa loamy fine sand, high bottom phase

Soil Management Group 19

Hadley very fine sandy loam
Hadley very fine sandy loam, low bottom phase
Hadley very fine sandy loam, high bottom phase
Hadley silt loam
Ondawa sandy loam
Ondawa fine sandy loam
Ondawa fine sandy loam, high bottom phase
Ondawa very fine sandy loam
Ondawa very fine sandy loam, high bottom phase
Ondawa silt loam
Ondawa silt loam, high bottom phase

Soil Management Group 20

Podunk loamy fine sand
Podunk fine sandy loam
Podunk very fine sandy loam
Podunk silt loam
Winooski fine sandy loam

Soil Management Group 21

Limerick silt loam
Podunk-Rumney fine sandy loam
Podunk-Rumney silt loam
Rumney fine sandy loam
Rumney silt loam

Soil Management Group 22

Alluvial soils, undifferentiated
Rumney-Saco soil
Saco fine sandy loam
Saco silt loam

Soil Management Group 23

Melrose fine sandy loam

Soil Management Group 24

Hartland very fine sandy loam
Hartland silt loam
Suffield very fine sandy loam
Suffield silt loam

Soil Management Group 25

Elmwood fine sandy loam

Soil Management Group 26

Buxton silt loam
Suffield silt loam, mottled subsoil phase

Soil Management Group 27

Scantic silt loam
Swanton fine sandy loam

Soil Management Group 28

Biddeford silt loam
Biddeford silty clay loam
Whately fine sandy loam

Soil Management Group 29

Berkshire very stony loam
Brookfield very stony loam
Gloucester very stony fine sandy loam
Hermon very stony fine sandy loam
Peru very stony loam
Waumbek-Peru-Acton stony undulating soil
Whitman very stony loam

Rough Stony Land, Deep Soil Material

a. Acworth material
b. Becket material
c. Becket soil material
d. Berkshire soil material
e. Brookfield material
f. Brookfield soil material
g. Essex soil material
h. Gloucester material
i. Gloucester soil material
j. Hermon material
k. Hermon soil material
l. Marlow material
m. Marlow soil material
n. Stony hilly and steep land
o. Very stony deep soils

Rough Mountain Land, Deep Soil Material

a. Berkshire soil material
b. Hermon soil material

Soil Management Group 30

Brimfield very stony loam
Canaan very stony fine sandy loam
Hollis very ledgy loam
Hollis very stony loam

Rolling Stony Land, Shallow Soil Material

a. Brimfield soil material
b. Hollis soil material
c. Rockingham soil material

Rough Stony Land, Shallow Soil Material

a. Brimfield soil material
b. Canaan soil material
c. Colrain soil material (Strafford County)
d. Hollis soil material
e. Lyman soil material
f. Rockingham soil material
g. Shapleigh soil material
h. Very stony or ledgy, shallow soils

Soil Management Group 31

Rockland
a. Brimfield
b. Canaan
c. Lempster
d. Marlow
e. Rock outcrop
f. Shapleigh

Soil Management Group 32

Coastal Beach
Dune Sand

Soil Management Group 33

Fresh Water Marsh
Tidal Marsh

Soil Management Group 34

Balch-Littlefield peat
Balch-Littlefield peat, shallow phase
Muck
Muck, shallow phase
Muck and peat
Peat
Peat, shallow phase
Waterboro muck
Waterboro muck, shallow phase

Soil Management Group 35

Made Land
Made Land (Organic)

Soil Management Group 36

Riverwash

Soil Conservation Service

The picture at top shows a poorly drained, fine-textured soil. In the picture at bottom the same field has been drained by bedding. Note field drains.

Appendix C

DRAINAGE CHARACTERISTICS OF WET SOIL TYPES

Soil Type	Feasibility to Drain*	Topographic Position	Cause of Poor Drainage				Degree of Natural Drainage			Can be Improved for	
			Dense Subsoil	High Water Table	Seepage	Surface Flooding	Mod. Well†	Poor	Very Poor	Row Crops	Hay or Pasture
Podunk loamy fine sand	x	Bottomland		x		x	x			x	
Podunk fine sandy loam	x	Bottomland		x		x	x			x	
Podunk very fine sandy loam	x	Bottomland		x		x	x			x	
Podunk silt loam	x	Bottomland		x		x	x			x	
Winooski very fine sandy loam	x	Bottomland		x		x	x			x	
Winooski silt loam	x	Bottomland		x		x	x			x	
Rumney fine sandy loam	x	Bottomland		x	x	x		x			x
Rumney silt loam	x	Bottomland		x	x	x		x			x
Saco fine sandy loam	x	Bottomland	x	x	x	x			x		x
Saco silt loam	?	Bottomland	x	x	x	x			x		x
Saco silty clay loam	?	Bottomland	x	x	x	x			x		x
Undifferentiated alluvial soils	Rarely	Bottomland		x	(From Terrace Banks)	x		x	x		x
Sudbury fine sandy loam	x	Level Terraces		x			x			x	
Sudbury very fine sandy loam	x	Level Terraces		x			x			x	
Walpole fine sandy loam	x	Level Terraces		x				x			x
Scarboro fine sandy loam	x	Level Terraces		x		x			x		x
Scarboro loam	x	Level Terraces		x		x			x		x
Saugatuck fine sandy loam	?	Level Terraces	Hardpan	x				x			x
Buxton silt loam	x	Flat Lake Plains	x				x			x	
Elmwood fine sandy loam	x	Flat Lake Plains	x				x			x	
Swanton fine sandy loam	x	Flat Lake Plains	x	x				x			x
Scantic silt loam	x	Flat Lake Plains	x	x		x		x			x
Biddeford silt loam	?	Flat Lake Plains	x	x		x			x		x
Biddeford silty clay loam	?	Flat Lake Plains	x	x		x			x		x
Whately fine sandy loam	?	Flat Lake Plains	x	x		x			x		x

* Indicates only whether drainage is feasible from a soils standpoint. Other factors such as whether suitable engineering grades and outlets can be obtained and whether cost of drainage is justified by anticipated returns will depend upon the facts in each individual case.

† Indicates moderately well drained.

APPENDIX C — Continued

Soil Type	Feasibility to Drain*	Topographic Position	Cause of Poor Drainage				Degree of Natural Drainage			Can be Improved for	
			Dense Subsoil	High Water Table	Seepage	Surface Flooding	Mod. Well‡	Poor	Very Poor	Row Crops	Hay or Pasture
†Acton fine sandy loam	x	Upland Slopes			x		x			x	
†Acton loam	x	Upland Slopes	x		x		x			x	
†Waumbek loam	x	Upland Slopes	x		x		x			x	
†Sutton loam	x	Upland Slopes	x		x		x			x	
†Sutton silt loam	x	Upland Slopes	x		x		x			x	
†Woodbridge loam	x	Upland Slopes	x		x		x			x	
†Woodbridge silt loam	x	Upland Slopes	x		x		x			x	
†Peru loam	x	Upland Slopes	x		x		x			x	
†Leicester loam	x	Upland Slopes	x	x	x	x		x			x
†Whitman loam	x	Upland Slopes	x	x	x	x			x		x
Muck and Peat (all phases). Not recommended for drainage except in rare instances for specific purposes											

* Indicates only whether drainage is feasible from a soils standpoint. Other factors such as whether suitable engineering grades and outlets can be obtained and whether cost of drainage is justified by anticipated returns will depend upon the facts in each individual case.

† Stony phases of these soils feasible to drain if stone removal cost not prohibitive.

‡ Indicates moderately well drained.